THE

REPERTORY

OF

ARTS, MANUFACTURES,

AND

AGRICULTURE.

NUMBER XXII. SECOND SERIES. March 1, 1804.

Specification of the Patent granted to RICHARD TREVITHICK *and* ANDREW VIVIAN, *of the Parish of Camborne, in the County of Cornwall, Engineers and Miners; for Methods for improving the Construction of Steam-Engines, and the Application thereof for driving Carriages, and for other Purposes.* Dated March 24, 1802.

With Plates.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Andrew Vivian do hereby declare that our said invention is described in manner following; that is to say: Our improvements in the construction and application of steam-engines are exhibited in the drawings hereunto annexed and explained, (see Plates IX. X. XI.) namely, Fig. 1 represents the vertical section of a steam-engine, with the said improvements; and Fig. 2 represents another vertical section of the same engine, at right angles to the plane of Fig. 1. The dark-shaded parts represent iron, and the red parts represent brick-work, and the yellow parts are brass, excepting only the wooden supporters of the great frame in Figs. 4 and 5, and the carriage wheels in Figs. 6 and

and 7*. A, represents the boiler made of a round figure, to bear the expansive action of strong steam. The boiler is fixed in a case D, luted inside with fire clay, the lower part of which constitutes the fire place B, and the upper cavity affords a space round the boiler, in which the flame or heated vapour circulates round till it comes to the chimney E. The case D, and the chimney, are fixed upon a platform F, the case being supported upon four legs; C, represents the cylinder inclosed for the most part in the boiler, having its nozzle, steam-pipe, and bottom, cast all in one piece, in order to resist the strong steam, and with sockets in which the iron uprights of the external frame are firmly fixed. G, represents a cock for conducting the steam, as may be more clearly seen by observing Fig. 3, which is a plan of the top of the cylinder, and the same parts in Fig. 2.—*b*, Figs. 2 and 3, represent the passage from the boiler to the cock G; this passage has a throttle valve, or shut, adjustible by the handle *m*. Fig. 2, so as to wiredraw the steam, and suffer the supply to be quicker or slower. The position of the cock, represented in Fig. 3, is such, that the communication from the boiler through *b*, by a channel in the cock is made good to *d*, which denotes the upper space of the cylinder above the piston, at the same time that the steam pipe *a*, (more fully represented in Fig. 1,) is made to afford a passage from the lower space in the cylinder beneath the piston to the channel C, through which the steam may escape into the outer air, or be directed and applied to heating fluids or other useful purposes. It will be obvious, that if the cock be turned one quarter of a turn in either direction, it will make a communication (Fig. 3.) from the

* The colouring is not introduced in our plates, but the respective materials which they indicate in the original will be obvious to every intelligent engineer.

boiler

boiler passage *b*, to the lower part of the cylinder by or through *a*, at the same time that the passage *r* from the upper part of the cylinder will communicate with C, the passage for conveying off the steam. P Q, is the piston-rod moving between guides, and driving the crank R S, by means of the rod Q R, the axis of which crank carries the fly T, and is the first mover to be applied to drive machinery as at S and W.

Fig 2. The alternations of action are made by the successive pressure of the steam above and below the piston, and these are effected by turning the cock a quarter turn at the end of each stroke, by means of the following apparatus most fully delineated in Fig. 1.

X Y, is a double snail, which in its rotation presses down the small wheel O, and raises the weight N by a motion on the joint M, of the lever O N, from which proceeds downwards an arm M L, and consequently the extremity L is at the same time urged outwards. This action draws the horizontal bar L I, and carries the lever or handle H I, which moves upon the axis of the cock G, through one-fourth of a circle. It must be understood that H I is fore-shortened, (the extremity I being more remote from the observer than the extremity H), and also that there is a click and ratchet wheel in the part H, which gathers up during the time that L is passing outwards, and does not then move the cock G; but that, when the part X, of the snail opposite O, that is to say, when the piston is about the top of its stroke, then the wheel O suddenly falls into the concavity of the snail; and the extremity of L by its return at once pushes I H through the quarter circle, and carries with it the cock G, and turns the steam upon the top of the piston, and also affords a passage for the steam to escape from beneath the piston. Every stroke, whether up or down,

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produces this effect by the half turn of the snail, and reverses the steam-ways as before described; or otherwise the cock may be turned by various well-known methods, such as the plug with pins or clamps striking on a lever in the usual way, and the effect will be the same, whether the quarter turns be made back or forward, or by a direct circular motion, as is produced by the machinery here delineated; but the wear of the cock will be more uniform and regular if the turns be all made the same way. In the steam engines constructed and applied according to our said invention, the steam is usually let off or conducted out of the engine; and in this case no vacuum is formed in the engine, but the steam after the operation is or may be usefully applied as before-mentioned; but whenever it is found convenient or necessary to condense the steam by injection-water, we use a new method of condensing by an injection above the bucket of the air-pump, and by this invention we render the condenser or space which is usually constituted or left between the said bucket, and a foot valve, entirely unnecessary; and we perfectly exclude the admission of any elastic fluid from the injection-water into the internal working spaces of the engine. In Fig. 2 is represented a method of heating the water for feeding the boiler by the admission of steam, after its escape through C into the cistern *f*; the steam passes under a false bottom *e*, perforated with small holes, and heats the water therein, a portion of which water is driven at every revolution of the fly by the small pump *k*, through *l z*, into the boiler A. We also, on some occasions, produce a more equable rotary motion in the several parts of the revolution of any axis moved by steam engines, by causing the piston rods of two cylinders to work on the said axis by cranks at one quarter turn asunder; by this means the

strongest

strongest part of the action of one crank is made to assist the weakest or most unfavourable part of the action in the other, and it becomes unnecessary to load the work with a fly. Fig. 4 is an upright section, and Fig. 5 is a plan of the engine with rollers, for pressing or crushing sugar canes, moved by a steam engine, improved and applied according to our said new invention; B, is a case in the form of a drum or cylinder, suspended upon two strong trunnions or pivots at O and O, its flat ends standing upright; within this iron case is fixed a boiler A, not much smaller in its dimensions, but so as to leave a vacant space between itself and the case, and within the boiler is fixed a fire-place, having its grate above the ash-hole D, and which the heated vapour and smoke rises at the inner extremity, and passes through two flues E E, Fig. 5, which join above at E *m*, Fig. 4, in the chimney E, which is there loosely applied, and is slung between centres in a ring at F. The working cylinder C, with its piston, steam-pipe, nozzle, and cock, are inserted in the boiler as here delineated. The piston rod drives the fly T T, upon the arbor of which is fixed a small wheel, which drives a great wheel upon the axis of the middle roller; the guides are rendered unnecessary in this application of the steam-engine, because the piston-rod is capable, by an horizontal vibratory motion of the whole engine upon its pivots O, to adapt itself to all the required positions, and while the lower portion of the chimney E *m*, Fig. 4, partakes of this vibratory motion, the upper tube. E F, is enabled to follow it by its play upon the two centres or pivots in the ring F. In such cases or constructions as may render it more desireable to fix the boiler with its chimney and other apparatus, and to place the cylinder out of the boiler, the cylinder itself may be suspended for the same purpose upon trun-

nions

nions or pivots in the same manner, one or both of which trunnions or pivots may be perforated, so as to admit the introduction and escape of the steam or its condensation as before-mentioned. And in such cases where it may be found necessary or expedient, to allow of no vibratory motion of the boiler or cylinder, the same may be fixed, and the method of guides be made use of as in Figs. 1 or 2. The manner in which the cock is turned is not represented in these two drawings, but every competent workman will, without difficulty, understand that this effect may be produced by the same means as in Fig. 1; or otherwise the stroke of pins duly placed in the circumference of the fly, and made to act upon a cross fixed on the axis of the cock, or otherwise by the method used in the carriage, Fig. 6, and hereinafter described. The steam which escapes in this engine is made to circulate in the case round the boiler, where it prevents the external atmosphere from affecting the temperature of the included water, and affords by its partial condensation a supply for the boiler itself, and is or may be afterwards directed to useful purposes as aforesaid. Fig. 6 is a verticle section; and Fig. 7 the plan of the application of the improved steam-engine, to give motion to wheel carriages of every description; B, represents the case, having therein the boiler with its fire-place and cylinder, as have been already described in Fig. 4. The piston rod P Q, Fig. 7, is divided or forked, so as to leave room for the motion of the extremity of the crank R; the said rod drives a cross piece at Q, backward and forward between guides, and this cross piece by means of the bar Q R, gives motion to the crank with its fly F, and to two wheels T T, upon the crank axis which lock into two correspondent wheels U, upon the naves of the large wheels of the carriage itself. The wheels T, are fixed

fixed upon round sockets, and receive their motion from a striking box or bar S X, which acts upon a pin in each wheel; S Y are two handles, by means of which either of the striking boxes S X can be thrown out of gear, and the correspondent wheel W by that means disconnected with the first mover for the purpose of turning short, or admitting a backward motion of that wheel when required; but either of the wheels W, in case of turning, can be allowed considerably to overrun the other without throwing S X out of gear, because the pin can go very nearly round in the forward motion before it will meet with any obstruction. The wheels U, are most commonly fixed upon the naves of the carriage-wheels W, by which means a revolution of the axis itself becomes unnecessary, and the outer ends of the said axis may consequently be set to any obliquity, and the other part fixed or bended as the objects of taste or utility may demand. The fore wheels are applied to direct the carriage by means of a lever H, and there is a chink lever which can be applied to the fly, in order to moderate the velocity of progression while going down hill. In the vertical section, *r u* denotes a springing lever, having a tendency to fly forward. Two levers of this kind are duly and similarly placed near the middle of the carriage, and each of them alternately thrown back by a short bearing lever S *t* upon the crank axis, which sends it home into the catch *u*, and afterwards disengages it when the bearing lever comes to press upon V, in which case the springing lever flies back. A cross bar, or double handle *o p*, is fixed upon the upright axis of the cock, from each end of which said cross bar proceeds a rod *p q*, which is attached to a stud *q*, that forms part of the spring lever *r u*. This stud has a certain length of play, by means of a long hole or groove in the bar, so that when

when the springing lever *r u*, is pressed up, the stud slides in the groove without giving motion to *p*. When the other springing lever is disengaged it draws the opposite end of *p o*, by which means *p* draws the long hole at *q* up to its bearing against the stud, ready for the letting off of that first-mentioned springing lever. When this last-mentioned lever comes to be disengaged, it suddenly draws *p* back, and turns the cock one quarter turn, and performs the like office of placing the horizontal rod of the other extremity of *p o*, ready for action by its own springing lever. These alternations perform the opening and shutting of the cock, and to one of the springing levers *r u* is fixed a small force pump *w*, which draws hot water from the case by the quick back stroke, and forces it into the boiler by the stronger and more gradual pressure of S *t*. It is also to be noticed that we occasionally, or in certain cases, make the external periphery of the wheels W uneven, by projecting heads of nails, or bolts, or cross grooves, or fittings to rail roads, when required, and that in cases of hard pull we cause a lever, bolt, or claw, to project through the rim of one or both of the said wheels, so as to take hold of the ground; but that in general the ordinary structure or figure of the external surface of these wheels will be found to answer the intended purpose. And, moreover, we do observe and declare, that the power of the engine, with regard to its convenient application to the carriage, may be varied, by changing the relative velocity of rotation of the wheels W, compared with that of the axis S, by shifting the gears or toothed wheels for others of different sizes, properly adapted to each other in various ways, which will readily be adopted by any person of competent skill in machinery. The body of the carriage M may be made of any convenient size or figure, according to its intended

uses.

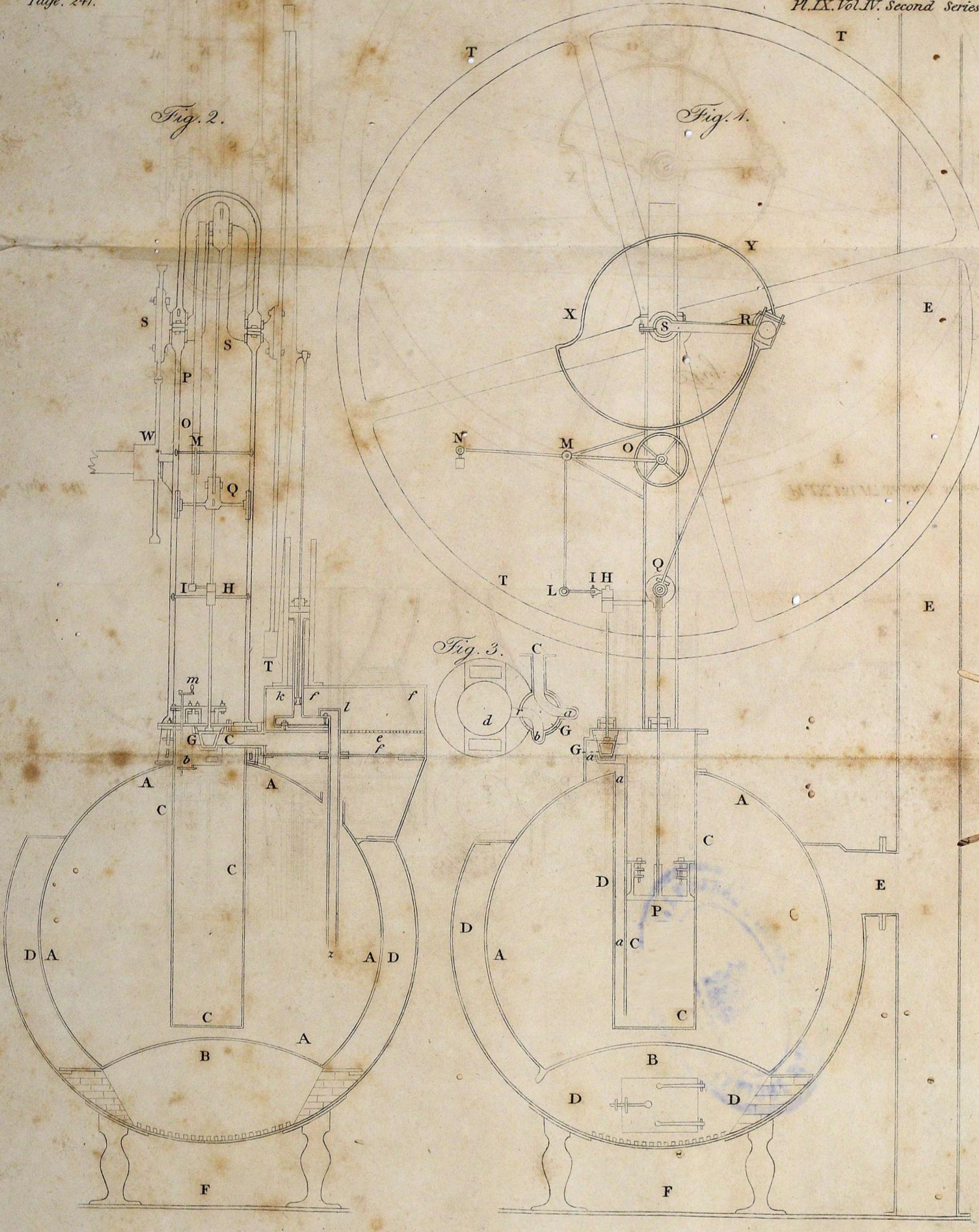

Fig. 2.
Fig. 1.
Fig. 3.

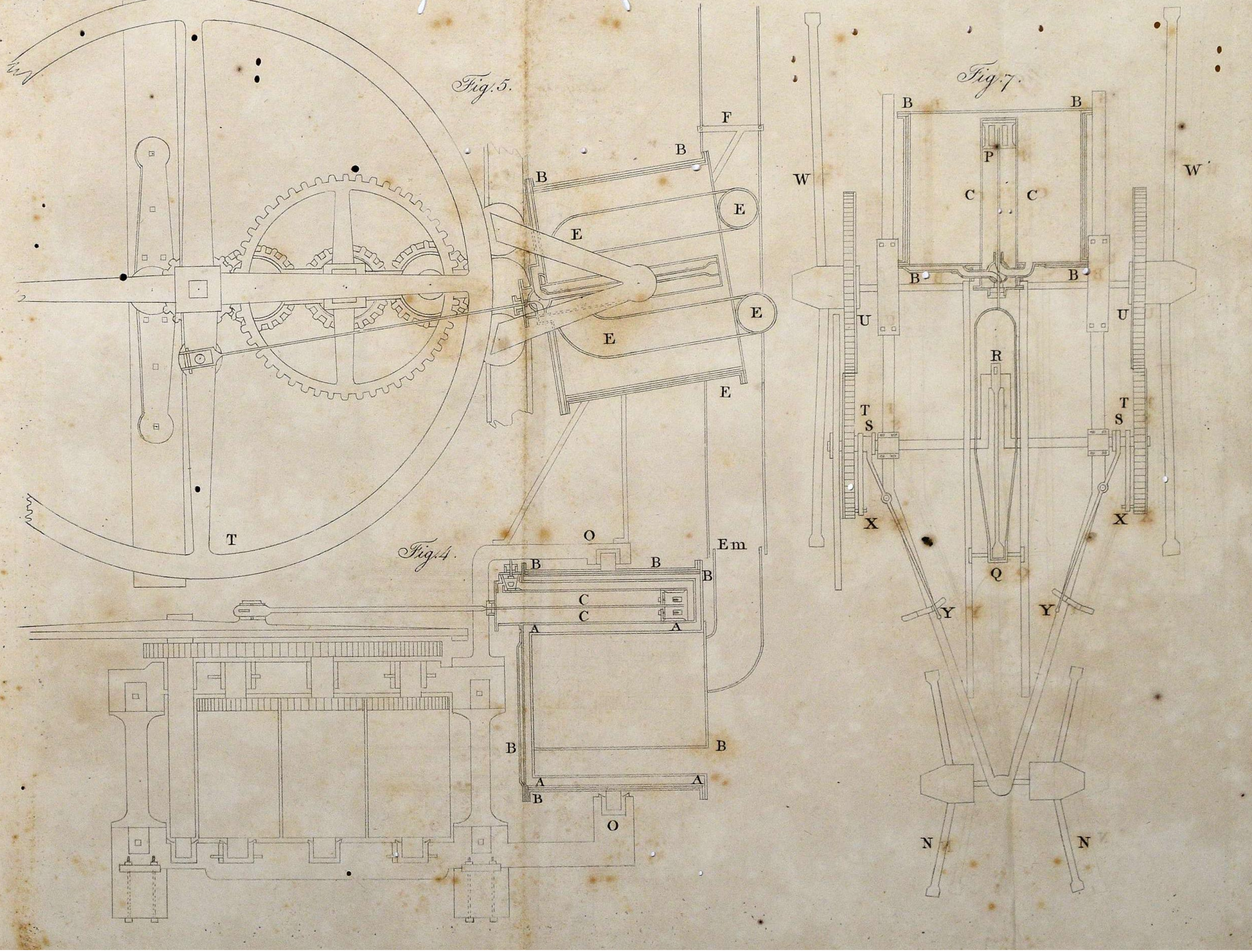

Fig. 5.
Fig. 7.
Fig. 4.
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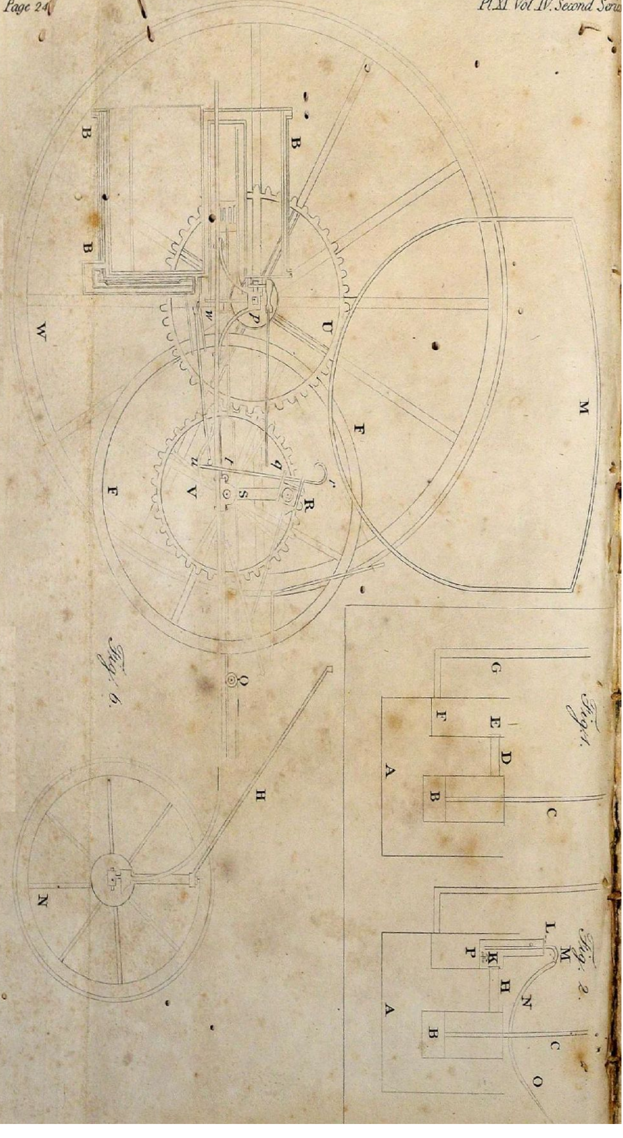

Fig. 6.

Fig. 1.

Fig. 2.

uses. And lastly, we do occasionally use bellows to excite the fire, and the said bellows are worked by the piston-rod or crank, and may be fixed in any situation or part of the several engines herein described, as may be found most convenient.

In witness whereof, &c.

Specification of the Patent granted to JOSEPH EVERETT, *of Salisbury, in the County of Wilts, Clothier; for a certain Article manufactured of different Materials, and wove in a peculiar Manner, so as to give it an Appearance of Velvet, which he denominates "Salisbury Angola Moleskin."* Dated June 30, 1803.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Joseph Everett do hereby describe and ascertain the nature of my said invention as follows; that is to say: I manufacture the Salisbury Angola Moleskin on two chains or warps, the upper chain is invariably woollen yarn, but the under chain is of cotton, linen, silk, mohair, or worsted. The above two chains are upon separate beams, the number of threads in the upper chain is two-fifths of the whole number in both chains; wires being introduced when the upper chain is clear upon the surface of the ground, and kept confined by three threads of weft till cut out by an instrument, the face or pile is formed; the weft is of cotton, linen, silk, mohair, worsted, or woollen yarn.

In witness whereof, &c.

Specification of the Patent granted to JOSEPH HATELY, *of Cradely, in the County of Worcester, Assayer of Metals; for some reducing Fluxes for the Purification of Mineral and Metallic Bodies, with combustive and phlogistive Substances from their primitive Ores, to purify Metals in Conjunction with or without compressed Air.*

Dated August 31, 1802.

TO all to whom these presents shall come, &c. I Joseph Hately do hereby describe that the nature of my said invention, and the manner in which the same is to be effected and performed, is particularly described and ascertained in the following specification herein-after mentioned; that is to say: The purification of mineral and metallic bodies extracted from their primitive ores, either in a crude or metallic state, is effected by the addition and application of the fluxes hereafter expressed, or any of them separately by themselves, or any mixture of them together, with or without absorbent substances of lime, gypsum, chalk, and whiting mixed therewith, consisting of the residue adhering to salt-pans and boilers, in which the sea-water brine from brine pits and salt rock are boiled, which is commonly called pancrach, common salt, rock salt, sal ammoniac, alum, glasgail called sandiver, nitre, tartar, vegetable, mineral, and animal salts; salts of any denomination in a humid or dry state.

In some cases I use salt water, brine from brine pits, or water strongly impregnated with any of the recited salts, in manner hereinafter described: viz. to refine copper, lead, tin, zinc, bismuth, and antimony, the ores are first cleaned and pulverized for melting in the usual manner, either in the great or small way.

The fluxes may be used either in a crude or prepared state; the latter I prefer, which is done by melting the salts

in

in melting pots or furnaces, and mixing them, or any of them, or all of them in equal parts, with two parts of the recited absorbent substances separately or together in a calcined state. Of that composition, I use two pounds weight to every hundred weight of crude ore, before expressed, and four pounds weight of the unprepared to the same quantity of ore aforesaid, more or less thereof, as the ores or metals may require for rendering them ultimately pure.

To refine iron ores, or iron mine, and pig metal made therefrom, the ores or mine thereof are to be pulverized and calcined in ovens or kilns with vegetable fuel, and the carbonated pit-coal, commonly called coaks, are washed in water, strongly impregnated with common salt or any of the recited salts before expressed, or sea water or brine from brine pits. The pig metal made therefrom, or the pig iron extracted by the usual process or common principles, I refine and purify with combustive and phlogistive substances, mineral or vegetable, prepared or unprepared as aforesaid, with addition of prepared or unprepared fluxes aforesaid, in proportion of three pounds thereof to one hundred weight of pig metal, more or less, as the foulness of the metal and fuel may require, when melting in a finery or in arunout fire, or in any other fire or furnace applicable thereto, with or without compressed air. The metal so refined as before expressed, or pig metal unrefined, is purified by the addition of the aforesaid fluxes in the following proportions: viz. to the refined metal as aforesaid, while it is in the puddling furnace or finery in a fluid state, I add thereto half a pound of the prepared flux, and to the unprepared pig metal in the puddling furnace is added four pounds of the said flux, more or less, if required to dispel the heterogeneous matter; but the former process

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I prefer when the iron is intended for the finest and best purposes, and for making steel, as the fluxes have the best effect when the metal is in contact with the fuel that possesses the least quantity of sulphur and other pernicious substances, that oppose malleability, ductility, and stability of metals.

In witness whereof, &c.

Specification of the Patent granted to WILLIAM BOOND, *of Manchester, in the County of Lancaster, Cotton Manufacturer; for a new Manufacture of mixed and coloured Cotton Velvets, Velveteens, Velverets, Thicksets, Cords, and other Cotton Pile Goods, commonly called Fustians.*

Dated April 5, 1803.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said William Boond do hereby particularly describe and ascertain the nature of my said invention, and in what manner the same is to be performed, as follows; that is to say: I take the cotton after it is picked and batted, or cleared of its seeds and other dirt which it may at any time collect by being exposed, and dye it or get it dyed in the usual way cotton is dyed, either fast or loose colours, to any shade or colour which fancy may dictate. After it is dyed I again batt it, open it, and pick out all the hard knots or lumps that would anywise injure the cards of the carding machine; and proceed to card, stretch, and rove it separately in the usual way cotton is carded, stretched, and roved; by this means I obtain dyed and undyed rovings. I now proceed to spin them together thus: I place a dyed roving and an undyed or coloured

coloured roving in the frame or creel of a spinning machine, made for that purpose, and spin two or more rovings together into one thread, or one spindle, or bobbin; by this means I make a mixture or mottled thread or weft, which weft I weave into the aforesaid goods; that is to say: cotton velvets, tabby or Genoa velveteens, tabby or Genoa velverets, tabby or Genoa thicksets, tabby or Genoa cords of every description whatever; or any other description of cotton or pile goods, commonly called fustians. After the goods are woven, I proceed to raise the pile or finish them, so as to shew the mixture or mottle thus: I cut the face or tuft of the pieces longitudinally in a frame with knives, as fustians in the grey are usually cut; after they are cut, I immerge them in lukewarm water, in which water I sometimes dissolve a little allum, or anything else that will serve to soften or brighten the colour, and dry them in the open air or in a stove. When the pieces are well dried, I rub them across or longitudinally with brushes, and a stone to raise the pile and make it knit together; this operation I repeat till such time as the pieces are well milled, and the pile well knit together; some pieces when they have undergone this last operation will be sufficiently finished and ready for sale; and on others there will be on the top of the pile a kind of down, or ouse, or loose strands of cotton, that will not knit in with the pile; these (if made of loose colours) I cut off with a large pair of shears (after the manner woollen cloth is sheared), to clear the pile and make the mixture more perceptible; this operation of shearing is repeated till the face or pile is clear to the satisfaction of the manufacturer, and the piece is then ready for sale; the goods that are made of such colours as will stand bleeching, I sometimes draw over a red-hot iron, to clear the pile, and afterwards bleach the

brown

brown off again, and sometimes clear them by shearing as above. There are several ways of making this mixed or mottled thread or weft; such as: first, by mixing the dyed and undyed, or coloured cotton together before carding; secondly, by stretching dyed and undyed cardings together on the stretching frame; thirdly, by roving dyed and undyed stretchings together on the roving frame; fourthly, by dying the weft in the hank, and doubling and twisting the dyed and undyed threads together; and fifthly, by clouding and stamping the weft before it is woven: all these ways I use, but give the preference to spinning the rovings together to make an even mixture as before. The part or parts I claim as my invention, is the weaving or manufacturing mixed or mottled cotton, weft, or yarn, prepared by the aforesaid means into such pile goods as before enumerated, and for finishing the same mixed or mottled goods after they are woven, so as to make a mixed or mottled pile in the aforesaid goods, similar to mixed or mottled woollen cloth or kerseymere by the aforesaid means, which have never been practised before on these kinds of cotton pile goods.

In witness whereof, &c.

A chemical Analysis of some Calamines. By James Smithson, *Esq. F. R. S.*

From the Philosophical Transactions of the Royal Society.

NOTWITHSTANDING the experiments of Bergman and others, on those ores of zinc which are called calamine, much uncertainty still subsisted on the subject of them. Their constitution was far from decided, nor was it

it ever determined whether all calamines were of the same species, or whether there were several kinds of them.

The Abbé Hauy, so justly celebrated for his great knowledge in crystallography and mineralogy, has adhered, in his late work *, to the opinions he had before advanced †, that calamines were all of one species, and contained no carbonic acid, being a simple calx of zinc, attributing the effervescence which he found some of them to produce with acids to an accidental admixture of carbonate of lime.

The following experiments were made to obtain a more certain knowledge of these ores; and their results will show the necessity there was for their farther investigation, and how wide from the truth have been the opinions adopted concerning them.

Calamine from Bleyberg.

a. The specimen which furnished the subject of this article was said, by the German of whom it was purchased, to have come from the mines of Bleyberg in Carinthia.

It was in the form of a sheet stalactite, spread over small fragments of limestone. Its texture was not however at all crystalline, but of the dull earthy appearance of chalk, though, on comparison, of a finer grain and closer texture.

It was quite white, perfectly opaque, and adhered to the tongue; 68.0 grs. of it, in small bits, immersed in distilled water, absorbed 19.8 grs. of it, = 0,29.

It admitted of being scraped by the nail, though with some difficulty: scraped with a knife, it afforded no light.

* Traité de Mineralogie, tome IV. † Journal des Mines.

68.1 grs. of it, broken into small pieces, expelled 19.0 grs. of distilled water from a stopple bottle. Hence its density = 3.584. In another trial, 18.96 grs. at a heat of 65° Fahrenheit, displaced 5.27 grs. of distilled water; hence the density = 3.598. The bits, in both cases, were entirely penetrated with water.

b. Subjected to the action of the blowpipe on the coal, it became yellow the moment it was heated, but recovered its pristine whiteness on being let cool. This quality, of temporarily changing their colour by heat, is common to most, if not all, metallic oxides; the white growing yellow, the yellow red, the red black.

Urged with the blue flame, it became extremely friable; spread yellow flowers on the coal; and, on continuing the fire no very long time, entirely exhaled. If the flame was directed against the flowers, which had settled on the coal, they shone with a vivid light. A bit fixed to the end of a slip of glass, wasted nearly as quickly as on the coal.

It dissolved in borax and microcosmic salt, with a slight effervescence, and yielded clear colourless glasses; but which became opaque on cooling, if over saturated. Carbonate of soda had not any action on it.

c. 68.0 grs. of this calamine dissolved in dilute vitriolic acid with a brisk effervescence, and emitted 9.2 grs. of carbonic acid. The solution was white and turbid, and on standing deposited a white powder, which, collected on a small filter of gauze paper, and well edulcorated and let dry, weighed only 0.86 gr. This sediment, tried at the blowpipe, melted first into an opaque white matter, and then partially reduced into lead. It was therefore, probably, a mixture of vitriol of lead and vitriol of lime.

The

The filtered solution, gently exhaled to dryness, and kept over a spirit-lamp, till the water of crystallization of the salt and all superfluous vitriolic acid were driven off, afforded 96.7 grs. of perfectly dry, or *arid**, white salt. On re-solution in water, and crystallization, this saline matter proved to be wholly vitriol of zinc, excepting an inappretiable quantity of vitriol of lime in capillary crystals, due, without doubt, to a slight and accidental admixture of some portion of the calcareous fragments on which this calamine had been deposited. Pure martial pruissate of tartar threw down a white precipitate from the solution of this salt.

In another experiment, 20.0 grs. of this calamine afforded 28.7 grs. of arid vitriol of zinc.

d. 10 grs. of this calamine were dissolved in pure marine acid, with heat. On cooling, small capillary crystals of muriate of lead formed in the solution. This solution was precipitated by carbonate of soda, and the filtered liquor let exhale slowly in the air; but it furnished only crystals of muriate of soda.

e. 10 grs. dissolved in acetous acid without leaving any residuum. By gentle evaporation, 20.3 grs. = 2.03, of acetite of zinc, in the usual hexagonal plates, were obtained. These crystals were permanent in the air, and no other kind of salt could be perceived amongst them.

Neither solution of vitriolated tartar, nor vitriolic acid, occasioned the slightest turbidness in the solution of these crystals, either immediately or on standing; a proof that

* *Dry*, as opposed to wet or damp, which are only degrees of each other, merely implies free from mechanically admixed water. *Arid*, may be appropriated to express the state of being devoid of combined water.

 the

the quantity of lime and lead in this solution, if any, was excessively minute.

f. A bit of this calamine, weighing 20.6 grs. being made red-hot in a covered tobacco-pipe, became very brittle, dividing on the slightest touch into prisms, like those of starch, and lost 5.9 grs. of its weight = 0.286. After this, it dissolved slowly and difficultly in vitriolic acid, without any effervescence.

According to these experiments, this calamine consists of,

Calx of zinc - -	0.714
Carbonic acid - -	0.135
Water - - -	0.151
	1.000

The carbonates of lime and lead in it are mere accidental admixtures, and in too small quantity to deserve notice.

Calamine from Somersetshire.

a. This calamine came from Mendip Hills in Somersetshire.

It had a mammillated form; was of a dense crystalline texture; semitransparent at its edges, and in its small fragments; and upon the whole very similar, in its general appearance, to calcedony.

It was tinged, exteriorly, brown; but its interior colour was a greenish yellow.

It had considerable hardness; it admitted, however, of being scraped by a knife to a white powder.

56.8 grs. of it displaced 13.1 grs. of water, at a temperature of 65° Fahrenheit. Hence its density = 4.336.

b. Exposed to the blowpipe, it became opaque, more yellow, and friable; spread flowers on the coal, and

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consequently volatilized, but not with the rapidity of the foregoing kind from Bleyberg.

It dissolved in borax and microcosmic salt, with effervescence, yielding colourless glasses. Carbonate of soda had no action on it.

c. It dissolved in vitriolic acid with a brisk effervesence; and 67.9 grs. of it emitted 24.5 grs. = 0.360, of carbonic acid. This solution was colourless; and no residuum was left. By evaporation, it afforded only vitriol of zinc, in pure limpid crystals.

d. 23.0 grs. in small bits, made red-hot in a covered tobacco-pipe, lost 8.1 grs. = 0.352. It then dissolved slowly and difficultly in vitriolic acid, without any emission of carbonic acid; and, on gently exhaling the solution, and heating the salt obtained, till the expulsion of all superabundant vitriolic acid and all water, 29.8 grs. of arid vitriol of zinc were obtained. This dry salt was wholly soluble again in water; and solution of pure martial prussiate of soda occasioned a white precipitate in it.

This calamine hence consissts of,

Carbonic acid - -	0.352
Calx of zinc - - -	0.648
	1.000.

Calamine from Derbyshire.

a. This calamine consisted of a number of small crystals, about the size of tobacco-seeds, of a pale yellow colour, which appeared, from the shape of the mass of them, to have been deposited on the surface of crystals of carbonate of lime, of the form of Fig. 28. Plate IV. of the *Cristallographie* of Romé de L'Isle.

The smallness of these calamine crystals, and a want of sharpness, rendered it impossible to determine their

form with certainty; they were evidently, however, rhomboids, whose faces were very nearly, if not quite, rectangular, and which were incomplete along their six intermediate edges, apparently like Fig. 78. Plate IV. of Romé de L'Isle.

22.1 grs. of these crystals, at a heat of 57° Fahrenheit, displaced 5.1 grs. of water, which gives their density = 4.333.

Heat did not excite any electricity in these crystals.

b. Before the blowpipe, they grow more yellow and opaque, and spread flowers on the coal. They dissolved wholly in borax and microcosmic salt, with effervescence.

c. 22.0 grs. during their solution in vitriolic acid, effervesced, and lost 7.8 grs. of carbonic acid = 0.354. This solution was colourless, and afforded 26.8 grs. of arid vitriol of zinc, which, redissolved in water, shot wholly into clear colourless prisms of this salt.

d. 9.2 grs. of these crystals, ignited in a covered tobacco-pipe, lost 3.2 grs. = 0.3478; hence, these crystals consist of,

Carbonic acid - - -	0.348
Calx of zinc - - -	0.652
	1.000.

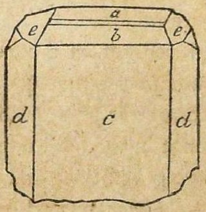
Electrical Calamine.

The Abbé Hauy has considered this kind as differing from the other calamines only in the circumstance of being in distinct crystals; but it has already appeared, in the instance of the Derbyshire calamine, that all crystals of calamine are not electric by heat, and hence, that it is not merely to being in this state that this species owes the above quality. And the following experiments, on some crystals of electric calamine from Regbania in Hungary,

Hungary, can leave no doubt of its being a combination of calx of zinc with quartz; since the quantity of quartz obtained, and the perfect regularity and transparency of these crystals, make it impossible to suppose it a foreign admixture in them.

a. 23.45 grs. of these Regbania crystals, displaced 6.8 grs. of distilled water, from a stopple-bottle, at the temperature of 64° Fahrenheit; their specific gravity is therefore = 3.434.

The form of these crystals is represented in the annexed Figure.



a c = 90°.
a e = 150°.
b c = 115°.
c d = 130°.

They were not scratched by a pin; a knife marked them.

b. One of these crystals, exposed to the flame of the blowpipe, decrepitated and became opaque, and shone with a green light, but seemed totally infusible.

Borax and microcosmic salt dissolved these crystals, without any effervescence, producing clear colourless glasses. Carbonate of soda had little if any action on them.

c. Ac-

c. According to Mr. Pelletier's experiments * on the calamine of Fribourg in Brisgaw, which is undoubtedly of this species, its composition is,

Quartz - - -	0.50
Calx of zinc - - -	0.38
Water - - - -	0.12
	1.00

The experiments on the Regbania crystals have had different results; but, though made on much smaller quantities, they will perhaps not be found, on repetition, less in conformity with nature.

23.45 grs. heated red-hot in a covered crucible, decrepitated a little, and became opaque, and lost 1.05 gr. but did not fall to powder or grow friable. It was found, that this matter was not in the least deprived of its electrical quality by being ignited; and hence, while hot, the fragments of these decrepitated crystals clung together, and to the crucible.

d. 22.2 grs. of these decrepitated crystals, = 23.24 grs. of the original crystals, in a state of impalpable powder, being digested over a spirit-lamp with diluted vitriolic acid, showed no effervescence; and, after some time, the mixture became a jelly. Exhaled to dryness, and ignited slightly, to expel the superfluous vitriolic acid, the mass weighed 37.5 grs.

On extraction of the saline part by distilled water, a fine powder remained, which, after ignition, weighed 5.8 grs. and was quartz.

The saline solution afforded, on crystallization, only vitriol of zinc.

* Journal de Physique, tome XX. p. 424.

These

These crystals therefore consist of,

Quartz - - -	0.250
Calx of zinc - -	0.683
Water - - -	0.044
	0.977
Loss - - -	0.023
	1.000.

The water is most probably not an essential element of this calamine, or in it in the state of, what is improperly called, water of crystallization, but rather exists in the crystals in fluid drops interposed between their plates, as it often is in crystals of nitre, of quartz, &c. Its small quantity, and the crystals not falling to powder on its expulsion, but retaining almost perfectly their original solidity, and spathose appearance in the places of fracture, and, above all, preserving their electrical quality wholly unimpaired, which would hardly be the case after the loss of a real element of their constitution, seem to warrant this opinion.

If the water is only accidental in this calamine, its composition, from the above experiments, will be,

Quartz - - -	0.261
Calx of zinc - - -	0.739
	1.000.

I have found this species of calamine amongst the productions of Derbyshire, in small brown crystals, deposited, together with the foregoing small crystals of carbonate of zinc, on crystals of carbonate of lime. Their form seems, as far as their minuteness and compression together would allow of judging, nearly or quite the same as that of those from Regbania; and the least atom of

of them immediately evinces its nature, on being heated, by the strong electricity it acquires. On their solution in acids, they leave quartz.

OBSERVATIONS.

Chemistry is yet so new a science, what we know of it bears so small a proportion to what we are ignorant of, our knowledge in every department of it is so incomplete, so broken, consisting so entirely of isolated points thinly scattered like lucid specks on a vast field of darkness, that no researches can be undertaken without producing some facts, leading to some consequences, which extend beyond the boundaries of their immediate object.

1. The foregoing experiments throw light on the proportions in which its elements exist in vitriol of zinc. 23.0 grs. of the Mendip Hill calamine, produced 29.8 grs. of arid vitriol of zinc. These 23.0 grs. of calamine contained 14.9 grs. of calx of zinc; hence, this metallic salt, in an arid state, consists of *exactly equal* parts of calx of zinc and vitriolic acid.

This inference is corroborated by the results of the other experiments: 68.0 grs. of the Bleyberg calamine, containing 48.6 grs. of calx of zinc, yielded 96.7 grs. of arid vitriol of zinc; and, in another trial, 20.0 grs. of this ore, containing 14.2 grs. of calx of zinc, produced 28.7 grs. of arid vitriol of zinc. The mean of these two cases, is 62.7 grs. of arid vitriol of zinc, from 31.4 grs. of calx of zinc.

In the experiment with the crystals of carbonate of zinc from Derbyshire, 14.35 grs. of calx of zinc furnished indeed only 26.8 grs. of arid vitriol of zinc; a deficiency of about $\frac{6}{100}$, occasioned probably by some small inaccuracy of manipulation.

2. When

2. When the simplicity found in all those parts, of nature which are sufficiently known to discover it is considered, it appears improbable that the proximate constituent parts of bodies should be united in them, in the very remote relations to each other in which analyses generally indicate them; and an attention to the subject has led me to the opinion that such is in fact not the case, but that, on the contrary, they are universally, as appears here with respect to arid vitriol of zinc, fractions of the compound of very low denominators. Possibly in few cases exceeding five.

The success which has appeared to attend some attempts to apply this theory, and, amongst others, to the compositions of some of the substances above analysed, and especially to the calamine from Bleyberg, induces me to venture to dwell here a little on this subject, and state the composition of this calamine which results from the system, as, besides contributing perhaps to throw some light on the true nature of this ore, it may be the means likewise of presenting the theory under circumstances of agreement with experiment, which, from the surprising degree of nearness, and the trying complexity of the case, may seem to entitle it to some attention.

From this calamine, containing, according to the results of the experiments on the Mendip Hill kind, too small a quantity of carbonic acid to saturate the whole of the calx of zinc in it, and from its containing much too large a portion of water to be in it in the state of mere moisture or dampness, it seems to consist of two matters; carbonate of zinc, and a peculiar compound of zinc and water, which may be named *hydrate of zinc*.

By the results of the analysis of the Mendip Hill calamine, corrected by the theory, carbonate of zinc appears to consist of,

 Car-

Carbonic acid	- -	$\frac{1}{3}$
Calx of zinc	- - -	$\frac{2}{3}$

Deducting from the calx of zinc in the Bleyberg calamine, that portion which corresponds, on these principles, to its yield of carbonic acid, the remaining quantity of calx of zinc and water is in such proportions as to lead, from the theory, to consider hydrate of zinc as composed of

Calx of zinc	- -	$\frac{3}{4}$
Water, or rather ice	- -	$\frac{1}{4}$.

And, from these results, corrected by the theory, I consider Bleyberg calamine as consisting of,

Carbonate of zinc	- -	$\frac{2}{5}$
Hydrate of zinc	- -	$\frac{3}{5}$

The test of this hypothesis is in the quantities of the remote elements which analysis would obtain from a calamine thus composed.

The following table will show how very insignificantly the calamine, compounded by the theory, would differ in this respect from the calamine of nature.

1000 parts of the compound salt of carbonate and hydrate of zinc consist of,

$$\text{Carbonate of zinc } 400 = \begin{cases} \text{Carbonic acid} = \frac{400}{3} = \text{ - - } & \text{— } 133\frac{1}{3} \\ \text{Calx of zinc} = \frac{400 \times 2}{3} = 266\frac{2}{3} \end{cases}$$

$$\text{Hydrate of zinc} = 600 \begin{cases} \text{Calx of zinc} = \frac{600 \times 3}{4} = 450 \\ \text{Ice - -} = \frac{600}{4} = \text{ - - } & 150 \end{cases}$$

$$266\frac{2}{3} + 450 = \text{— } 716\frac{2}{3}$$

1000.

Great

Great as is the agreement between the quantities of the last column and those obtained by the analysis of the Bleyberg calamine (page 266), it would be yet more perfect, probably, had there been, in this instance, no sources of fallacy but those attached to chemical operations, such as errors of weighing, waste, &c. but the differences which exist are owing, in some measure at least, to the admixture of carbonate of lime and carbonate of lead, in the calamine analysed, and also to some portion of water, which is undoubtedly contained, in the state of moisture, in so porous and bibulous a body.

It has also appeared, in the experiments on the Mendip Hill calamine, that acids indicate a greater quantity of carbonic acid than fire does, by $\frac{22}{1000}$. If we make this deduction for dissolved water, it reduces the quantity of carbonic acid in the Bleyberg calamine to 0.1321.

If we assume this quantity of carbonic acid as the datum to calculate, on this system, the composition of the calamine from Bleyberg, we shall obtain the following results:

Compound salt, of carbonate of zinc and hydrate of zinc - - -	990.3
Water, in the state of moisture - -	2.5
Carbonate of zinc and carbonate of lead -	7.2
	1000.0

It may be thought some coroboration of the system here offered, that, if we admit the proportions which it indicates, the remote elements of this ore, while they are regular parts of their immediate products, by whose subsequent union this ore is engendered, are also regular fractions of the ore itself: thus,

The carbonic acid - $= \frac{8}{60}$

The water - - $= \frac{9}{60}$

The calx of zinc - - $= \frac{43}{60}$

 Heredy

Hereby displaying that sort of regularity, in every point of view of the object, which so wonderfully characterises the works of nature, when beheld in their true light.

If this calamine does consist of carbonate of zinc and hydrate of zinc, in the regular proportions above supposed, little doubt can exist of its being a true chemical combination of these two matters, and not merely a mechanical mixture of them in a pulverulent state; and, if so, we may indulge the hope of some day meeting with this ore in regular crystals.

If the theory here advanced has any foundation in truth, the discovery will introduce a degree of rigorous accuracy and certainty into chemistry, of which this science was thought to be ever incapable, by enabling the chemist, like the geometrician, to rectify by calculation the unavoidable errors of his manual operations, and by authorising him to discriminate from the essential elements of a compound those products of its analysis whose quantity cannot be reduced to any admissible proportion.

A certain knowledge of the exact proportions of the constituent principles of bodies, may likewise open to our view harmonious analogies between the constitutions of related objects, general laws, &c. which at present totally escape us. In short, if it is founded in truth, its enabling the application of mathematics to chemistry cannot but be productive of material results *.

3. By the application of the foregoing theory to the experiments on the electrical calamine, its elements will appear to be,

* It may be proper to say, that the experiments have been stated *precisely* as they turned out, and have not been in the *least degree* bent to the system.

Qurrtz

Quartz - - -	$\frac{1}{4}$
Calx of zinc - - - -	$\frac{3}{4}$

A small quantity of the calamine having escaped the action of the vitriolic acid, and remained undecomposed, will account for the slight excess in the weight of the quartz.

4. The exhalation of these calamines at the blowpipe, and the flowers which they diffuse round them on the coal, are probably not to be attributed to a direct volatilization of them. It is more probable that they are the consequences of the disoxidation of the zinc calx, by the coal and the inflammable matter of the flame, its sublimation in a metallic state, and instantaneous recalcination. And this alternate reduction and combustion may explain the peculiar phosphoric appearance exhibited by calces of zinc at the blowpipe.

The apparent sublimation of the common flowers of zinc at the instant of their production, though totally unsublimable afterwards, is certainly likewise but a deceptious appearance. The reguline zinc, vaporized by the heat, rises from the crucible as a metallic gas, and is, while in this state, converted to a calx. The flame which attends the process is a proof of it; for flame is a mass of vapour, ignited by the production of fire within itself. The fibrous form of the flowers of zinc is owing to a crystallization of the calx while in *mechanical suspension* in the air, like that which takes place with camphor, when, after having been some time inflamed, it is blown out.

A moment's reflection must evince, how injudicious is the common opinion, of crystallization requiring a state of solution in the matter; since it must be evident, that while solution subsists, as long as a quantity of fluid admitting of it is present, no crystallization can take place.

The

The only requisite for this operation is a freedom of motion in the masses which tend to unite, which allows them to yield to the impulse which propels them together, and to obey that sort of polarity which occasions them to present to each other the parts adapted to mutual union. No state so completely affords these conditions as that of mechanical suspension in a fluid whose density is so great, relatively to their size, as to oppose such resistance to their descent in it as to occasion their mutual attraction to become a power superior to their force of gravitation. It is in these circumstances that the atoms of matters find themselves, when, on the separation from them of the portion of fluid by which they were dissolved, they are abandoned in a disengaged state in the bosom of a solution; and hence it is in saturated solutions sustaining evaporation, or equivalent cooling, and free from any perturbing motion, that regular crystallization is usually effected.

But those who are familiar with chemical operations, know the sort of agglutination which happens between the particles of subsided very fine precipitates; occasioning them, on a second diffusion through the fluid, to settle again much more quickly than before, and which is certainly a crystallization, but under circumstances very unfavourable to its perfect performance.

5. No calamine has yet occurred to me which was a real, uncombined, calx of zinc. If such, as a native product, should ever be met with in any of the still-unexplored parts of the earth, or exist amongst the unscrutinized possessions of any cabinet, it will easily be known, by producing a quantity of arid vitriol of zinc exactly double its own weight; while the hydrate of zinc, should it be found single, or uncombined with the carbonate, will yield, it is evident, 1.5 its weight of this arid salt.

On

On Meteorology, as applicable to Husbandry.

By the Rev. Mr. HOLMES.

FROM HUNTER'S GEORGICAL ESSAYS.

IT is obvious from the effects of the weight and temperature of the air, upon the barometer and thermometer, that the same causes must operate at the same time upon the animal and vegetable kingdoms. If, therefore, the science of meteorology can be rendered subservient to the purposes of the husbandman, so as to enable him to prognosticate the changes of the weather, and the nature of these changes, it appears to me, that the philosopher should direct the farmer's attention to such phænomena in the animal and vegetable kingdoms as may be found to predict such changes. For it is evident, that whatever the most unexceptionable theory, or even demonstration, might effect — in the abstruse, scientific manner of Mr. Kirwan, in his late ingenious essay on the Temperature of different Latitudes, or the truly sagacious and indefatigable Mr. De Luc, in his repeated inquiries into the Modifications of the Atmosphere — it could not be accommodated to the comprehension of a common farmer, except in the way of popular corollaries or inferences. Undoubtedly most of the physical phænomena of meteorology, properly so called, depend upon the incessant decomposition and recomposition of the expansible fluids contained in the atmosphere; yet if the philosopher, capable of accounting for these phænomena, cannot reduce his deductions from them into such language as is intelligible to a common farmer, their utility must consequently be limited to those who perhaps have least occasion to apply them to the exigencies of common life. If such be

be the case, it must be the ardent wish of every friend to the real interests of agriculture — an art universally acknowledged of the last importance to man — that philosophers, capable of executing the task with propriety, would condescend to direct the farmer's attention to such obvious phænomena as might enable him to prognosticate the changes of the weather, which more immediately influence his most important operations. That such phænomena as would answer this desirable purpose are exhibited in the animal and vegetable kingdom, I flatter myself might be easily discovered by a judicious and attentive observer. And though the information derived from these sources might not be so extensive, or afford so much time for application, as that deduced from the other, (supposing abilities for such deduction,) the easiness of its application would more than compensate for this deficiency. For these reasons, I am fully persuaded, that the result of accurate observations, made upon the animal and vegetable kingdoms, and occasionally published, till a mass of well-authenticated information were collected, sufficient to constitute a popular directory, to ascertain the changes of the weather, would be an important acquisition not only to agriculture, properly so called, but to all the most interesting operations of the farmer. From this investigation, I would by no means exclude the use of the barometer, thermometer, hygrometer, or any other instruments calculated to show the changes in the state of the atmosphere; as I have sanguine hopes that the appearances indicated by them may be reduced to much greater accuracy and precision, by comparing them with the phænomena of nature, in the manner I am now recommending to the attentive observer, than can be collected from them at present. As to myself, I can truly declare, that with the strictest attention, and some little

little meteorological knowledge, I have for many years examined and registered the indications of these instruments, without being able to make the least useful deduction from any of them, as a farmer, or derive any scientific information from them, excepting the thermometer, as a philosopher. The common farmer, therefore, absolutely wants some easy certain rules to ascertain the changes of the weather, and the nature of these changes; for information in the latter case it is in vain to consult any mechanical instruments. If then the animal, vegetable, and mineral kingdoms, particularly the two first, exhibit such appearances as indicate a change of weather, and by accurate and repeated observations we be enabled to prognosticate the nature of that change, we shall have a sure criterion of the weather from the vernal to the autumnal equinox, a season of prime importance to the farmer. We know from experience, particularly such of us as are of a delicate, irritable constitution, that changes of the weather affect us very sensibly; and analogy leaves us not the least reason to doubt but that every beast, bird, and insect are affected by the same causes, and, if attentively observed, would afford useful information with respect to these changes. Many vegetables too exhibit very curious and significant indications of atmospherical influences, and repeated observations made upon these, corrected and assisted by collateral observations made upon the other sources of meteorological information, would in time afford such certain and infallible rules for prognosticating the weather, as would not be far short of absolute demonstration. I hope no person will object to the unwarrantable extension I have given to the meaning of the word meteorology; I am conscious that what I am recommending to the attention of the philosophical observers of nature, is not properly the

science of meteors, but of their effects; but if it be a more compendious, more popular, and consequently a more useful way of discovering the changes of the weather, the misapplication of a word will not I hope be considered as of much importance. When I add, that the Shepherd of Banbury's Rules for judging of the Weather should be examined, corrected, and extended, as an additional and important supplement to this plan, it may with propriety be intitled meteorological.

On the Preparation, Culture, and Use of the Orchis Root.

By J. PERCIVAL, *M. D.*

FROM HUNTER'S GEORGICAL ESSAYS.

SALEP is a preparation of the root of Orchis, or Dog-stones, of which many species are enumerated by botanical writers. The *Orchis mascula Linn. sp. pl.* is the most valued, although the roots of some of the palmated sorts, particularly of the *Orchis Latifolia*, are found to answer almost equally well. This plant flourishes in various parts of Europe and Asia, and grows in our country spontaneously, and in great abundance. It is assiduously cultivated in the East; and the root of it forms a considerable part of the diet of the inhabitants of Turkey, Persia, and Syria. A dry, and not very fertile soil is best adapted to its growth. An ingenious friend of mine, in order to collect the seed, transplanted a number of the Orchises into a meadow, where he had prepared a bed well manured for their reception. The next spring few of them appeared, and not one came to maturity, their roots being black and half rotten. The same gentleman

tleman informed me that he had never been able to raise any plants from the seed of the wild Orchis; but he ascribes his want of success to the wetness of the situation in which he resides. I have now before me a seed pod of the Orchis, the contents of which, to the naked eye, seem to be seed corrupted and turned to dust; but, when viewed through a microscope, appear evidently to be organized, and would, I doubt not, with proper culture, germinate, and produce a thriving crop of plants. The properest time for gathering the roots is when the seed is formed, and the stalk is ready to fall, because the new bulb, of which the salep is made, is then arrived to its full maturity, and may be distinguished from the old one, by a white bud rising from the top of it, which is the germ of the Orchis of the succeeding year.

Several methods of preparing salep have been proposed and practised. Geoffroy has delivered a very judicious process, for this purpose, in the *Histoire de l'Academie Royale des Sciences*, 1740; and Retzius, in the Swedish Transactions, 1764, has improved Geoffroy's method. But Mr. Moult, of Rochdale, has lately favoured the public with a new manner of curing the Orchis root: and as I have seen many specimens of his salep, at least equal, if not superior, to any brought from the Levant, I can recommend the following, which is his process, from my own knowledge of its success. The new root is to be washed in water, and the fine brown skin which covers it is to be separated by means of a small brush, or by dipping the root in hot water, and rubbing it with a coarse linen cloth. When a sufficient number of roots have been thus cleaned, they are to be spread on a tin-plate, and placed in an oven heated to the usual degree, where they are to remain six or ten minutes, in which time they will have lost their milky whiteness, and ac-

quired a transparency like horn, without any diminution of bulk. Being arrived at this state, they are to be removed, in order to dry and harden in the air, which will require several days to effect; or, by using a very gentle heat, they may be finished in a few hours *.

Salep, thus prepared, may be afforded, in this part of England, where labour bears a high value, at about 8d. or 10d. per lb. And it might be sold still cheaper, if the Orchis were to be cured without separating from it the brown skin which covers it;—a troublesome part of the process, and which does not contribute to render the root either more palatable or salutary. Whereas the foreign salep is now sold at 5s. or 6s. per lb.

The culture of the Orchis, therefore, is an object highly deserving of encouragement from all the lovers of agriculture. And as the root, if introduced into common use, would furnish a cheap, wholesome, and most nutritious article of diet, the growth of it would be sufficiently profitable to the farmer.

Salep is said to contain the greatest quantity of vegetable nourishment in the smallest bulk. Hence a very judicious writer, to prevent the dreadful calamity of famine at sea, has lately proposed that the powder of it should constitute part of the provisions of every ship's company. This powder and portable soup, dissolved in boiling water, form a rich thick jelly, capable of supporting life for a considerable length of time. An ounce of each of these articles, with two quarts of boiling water, will be sufficient subsistence for a man a day †; and, as

* Vid. A Letter from Mr. John Moult to the Author, containing a new method of preparing salep.—Phil. Transact. vol. 59.

† Portable soup is sold at 2s 6d. per lb.; salep, if cultivated in our own country, might be afforded at 10d. per lb.; the day's subsistence would therefore amount only to 2½d.

being

being a mixture of animal and vegetable food, must prove more nourishing than double the quantity of rice-cake, made by boiling rice in water. This last, however, sailors are often obliged solely to subsist upon for several months, especially in voyages to Guinea, when the bread and flour are exhausted, and the beef and pork, having been salted in hot countries, are become unfit for use *.

But, as a wholesome nourishment, rice is much inferior to salep. I digested several alimentary mixtures prepared of mutton and water, beat up with bread, sea-biscuit, salep, rice-flour, sago-powder, potatoe, old cheese, &c. in a heat equal to that of the human body. In forty-eight hours they had all acquired a vinous smell, and were in brisk fermentation, except the mixture with rice, which did not emit many air bubbles, and was but little changed. The third day several of the mixtures were sweet, and continued to ferment; others had lost their intestine motion, and were sour; but the one which contained the rice was become putrid. From this experiment it appears that rice, as an aliment, is slow of fermentation, and a very weak corrector of putrefaction. It is therefore an improper diet for hospital patients; but more particularly for sailors, in long voyages, because it is incapable of preventing, and will not contribute much to check the progress of that fatal disease, the sea-scurvy †. Under certain circumstances, rice seems disposed

* Vide Dr. Lind's Appendix to his Essay on the Diseases of Hot Climates.

† Cheese is now become a considerable article of ship provisions. When mellowed by age, it ferments readily with flesh and water, but separates a rancid oil, which seems incapable of any further change, and must, as a septic, be pernicious in the scurvy; for rancidity appears to be a species of putrefaction. The same objection may be urged,

posed of itself, without mixture, to become putrid; for by long keeping, it sometimes acquires an offensive fœtor; nor can it be considered as a very nutritive kind of food, on account of its difficult solubility in the stomach. Experience confirms the truth of this conclusion: For it is observed by the planters in the West Indies, that the negroes grow thin, and are less able to work whilst they subsist upon rice.

Salep has the singular property of concealing the taste of salt-water *; a circumstance of the highest importance at sea, when there is a scarcity of fresh water. I dissolved a drachm and half of common salt in a pint of the mucilage of salep, so liquid as to be potable, and the same quantity in a pint of spring water. The salep was by no means disagreeable to the taste, but the water was rendered extremely unpalatable.

This experiment suggested to me the trial of the Orchis root as a corrector of acidity; a property which would render it a very useful diet for children. But the solution of it, when mixed with vinegar, seemed only to dilute, like an equal proportion of water, and not to cover its sharpness.

Salep, however, appears by my experiments, to retard the acetous fermentation of milk, and consequently would be a good lithing for milk pottage, especially in large towns, where the cattle, being fed upon sour draff, must yield acescent milk.

Salep, in a certain proportion, which I have not yet been able to ascertain, would be a very useful and pro-

urged, with still greater propriety, against the use of cheese in hospitals; because convalescents are so liable to relapses, that the slightest error of diet may occasion them. Vide Percival's Letter to Mr. Aikin. —Thoughts on Hospitals, p. 95.

* Vide Dr. Lind's Appendix.

fitable

fitable addition to bread. I directed one ounce of the powder to be dissolved in a quart of water, and the mucilage to be mixed with a sufficient quantity of flour, salt, and yeast. The flour amounted to two pounds, the yeast to two ounces, and the salt to eighty grains. The loaf when baked was remarkably well fermented, and weighed three pounds two ounces. Another loaf, made with the same quantity of flour, &c. weighed two pounds and twelve ounces: from which it appears that the salep, though used in so small a proportion, increased the gravity of the loaf six ounces, by absorbing and retaining more water than the flour alone was capable of. Half a pound of flour and an ounce of salep were mixed together, and the water added according to the usual method of preparing bread. The loaf, when baked, weighed thirteen ounces and a half; and would probably have been heavier, if the salep had been previously dissolved in about a pint of water. But it should be remarked, that the quantity of flour used in this trial was not sufficient to conceal the peculiar taste of the salep.

The restorative, mucilaginous, and demulcent qualities of the Orchis-root render it of considerable use in various diseases. In the sea-scurvy it powerfully obtunds the acrimony of the fluids, and at the same time is easily assimulated into a mild and nutritious chyle. In diarrhœas and the dysentery, it is highly serviceable, by sheathing the internal coat of the intestines, by abating irritation, and gently correcting putrefaction. In the symptomatic fever, which arises from the absorption of pus, from ulcers in the lungs, from wounds, or from amputation, salep, used plentifully, is an admirable demulcent, and well adapted to resist that dissolution of the crasis of the blood, which is so evident in these cases.

And

And by the same mucilaginous quality, it is equally efficacious in the strangury and dysury; especially in the latter, when arising from a venereal cause; because the discharge of urine is then attended with the most exquisite pain, from the ulcerations about the neck of the bladder, and through the course of the urethra. I have found it also an useful aliment for patients who labour under the stone or gravel *.

From these observations, short and imperfect as they are, I hope it will sufficiently appear that the culture of the Orchis root is an object of considerable importance to the public, and highly worthy of encouragement from all the patrons of agriculture. That taste for experiment, which characterises the present age, and which has so amazingly enlarged the boundaries of science, now animates the RATIONAL FARMER, who fears not to deviate from the beaten tract whenever improvements are suggested, or useful projects pointed out to him. Much has been already done for the advancement of agriculture; but the earth still teems with treasures which remain to be explored. The bounties of Nature are inexhaustible, and will for ever employ the art, and reward the industry of man.

* The ancient chymists seem to have entertained a very high opinion of the virtues of the Orchis root, of which the following quotation from the SECRETA SECRETORUM of Raymund Lully affords a diverting proof. The work is dated 1565.

SEXTA HERBA.

Satirion.

"Satirion herba est pluribus nota, hujus radicis collecta ad pondus lib. 4. die 20 mensis Januarij, contunde fortiter et massam contusam pone in ollam de aurichalco habente in cooperculo 20 foramina minuta sicut athomi, & pone intus cù prædicta messa lactis vaccini calidi sicut mulgetur de vacca lb. 3. et mellis libram 1. vini aromatici lb. 2. et repone per dies 20. ad solem et conserva et utere."

"Istius itaq; dosis ad pondus 3. 4. et hora diei decima exhibita mulieri post ipsius menstrua eadem nocte còcipiet si vir cum ea agat."

Description

Description of an Apparatus for extinguishing Fires which may happen in Cotton Factories, &c. to be attached to Steam-Engines or Water-Mills.

Communicated by the Author, in a Letter to the Editors.

With a Plate.

THE great fires which frequently happen in cotton factories have made me (who live adjoining to one) very uneasy, and caused me to turn my thoughts to a plan for the extinguishing of them at the beginning. Various are the methods made use of by different manufacturers, which are all of them very proper precautions. In some factories, tubs of water, with wet blankets in them, are placed in each room, ready to throw on the place where the accident may happen. In other factories, besides this precaution, cisterns are placed at the top of the building, with pipes and cocks into every room, by which the floors may be covered with water almost instantaneously. If these or similar methods should fail of the desired effect, and if extinguishing-engines cannot be brought in time, the building must inevitably be consumed. Those persons who work the machinery with steam-engines or a water-wheel, might attach to some part of the work an extinguishing-engine, which of course would have prodigious power. Mr. Peter Marsland, of Stockport, has attached one to his water-wheel, which is placed in the centre of a square, surrounded with cotton factories. In the same manner an extinguishing-engine might be attached to the working beam of a steam-engine; but as these methods are attended with considerable expense, few persons choose to have them.

The plan which I propose would be attended with little expense, would nearly answer the same end, and would

would sooner be set to work; which, at the beginning of a fire, is of very great importance.

The annexed plan is suited for those who work with Boulton and Watts's patent engines.

Fig. 1 is the plan of a cistern, &c. in the common mode of working.

Fig. 2 is the same plan, with the addition of the air vessel or fire-engine.

References to Plate XI.

Fig. 1, A, the cold water cistern.

B, the pump which brings the air and water out of the condenser, commonly called the air-pump.

C, the piston-rod, which works in the air-pump through a stuffing-box.

D, the communication between the air-pump and the hot water cistern.

E, a valve through which the water passes into the hot water cistern.

F, the hot water cistern.

G, the hot water pump.

Fig. 2, H, the communication between the air-pump and the air vessel or engine for extinguishing fire, with a valve at the end K, through which the water passes into the air-vessel.

K, the air-vessel.

L, the pipe through which the water is forced by the compression of the air.

M, an elbow joint to which the leather pipes are attached.

N, the leather pipes, which may be lengthened so as to play into any room of the building, which is worked by the steam-engine.

O, the branch-pipe.

P,

P, a cock, which is opened into the hot water cistern, through which the water passes when the steam-engine is at work.

When the fire-engine is wanted to work, this cock is shut, and the water having no other way to escape is forced, by the compression of the air, up the tube, at a very considerable velocity. All the water which is pumped up by the jack-pump may by this machine be forced through the branch-pipe, which must in all probability extinguish any fire at the beginning, when the quantity of water brought up by the jack-pump is from thirty, forty, fifty, sixty, or seventy gallons *per* minute, according to the power of the engine.

Method of converting into Ether almost the Whole of any Quantity of Alkohol, by mixing three Parts of that Liquid with one Part of Sulphuric Acid.

By M. VAN MONS.

From the JOURNAL DE CHIMIE.

I DISCOVERED by accident a method of converting into ether almost the whole of any quantity of alkohol without employing above one part of sulphuric acid to three parts of the former liquid. I was led to this discovery by the following circumstance.

I had mixed at three times, in a stone pan, four pounds of sulphuric acid with nine pounds of alkohol, intending to make ethereous alkohol with sulphuric acid (the mineral anodyne liquor of Hoffman). The alkohol marked thirty-four degrees on Baumé's areometer. The retort which I had at hand not being large enough to contain the whole of the mixture, I at first submitted only half of it to distillation. The operation was performed by a

 heat

heat that produced a slight ebullition. The remaining portion was poured on the residue in the retort, and distilled as before. The produce of the distillation was about three-fourths of the whole quantity.

The other fourth consisted of two different liquids; one of these, to the quantity of eight-ninths, was uppermost. This supernatant liquor was ether, and that underneath consisted of water mixed with ethereous alkohol.

This extraordinary formation of ether made me desirous of knowing the quantity of that liquid contained in the first distilled liquor. I therefore added a quantity of water to a few ounces of that liquor, and I observed that almost the whole was converted into ether. I then added water to the total quantity, and obtained above three pounds more of it.

It was natural to attribute this abundant production of ether to the presence of the acid in the residue left in the retort, or to the co-operation of the residue of the first distillation in the second. Wishing to see to what length this production of ether might be carried, by the same method, I poured the liquor of the first distillation, which yielded no more ether by the addition of water, upon the total residue, and distilled it with a strong ebullition; by this second operation above half of the ethereous alkohol was converted into ether.

Besides furnishing an almost incredible quantity of ether, this process possesses the advantage of saving three-fourths of the acid usually employed in preparing that liquid.

The pouring off of liquor produced by a single distillation, affords no ether separable by means of water from the total quantity of liquor. But this practice, together with a previous digestion of the distilled liquor, with a new fourth part of sulphuric acid, converts almost the whole into ethereous alkohol or ether.

From

From this result, and the consideration that the ether is not formed till towards the conclusion of the distillation, it appears that ethereous alkohol is not a mixture of alkohol and ether, but ether in an imperfect state, semi-etherified alkohol or semi-ether.

The abundant production of ether, in the operation I have here described, will tend to correct the erroneous opinion, that the alkohol of grain is less proper than that of the grape for furnishing ether.

Method of speedily producing Fruit from Trees inclined to run to Wood, of obtaining fine Shoots, and increasing the Strength of Timber-Trees.

By A. G. M. SURIRAY DELARUE.

From the JOURNAL PHYSICO-ECONOMIQUE.

THERE are few Horticulturists who have not the mortification to see in their orchards a number of fruit-trees of the apple kind, that push out abundance of vigorous branches, but yet constantly remain barren, notwithstanding the luxuriance of their growth. To remedy this defect, it has been recommended to bore a hole in the trunk of the tree and to put into it a wooden peg, or to dig at the foot of the tree and cut off one or more of the large roots. This troublesome process, however, has been attended with very uncertain success, and has therefore been but little practised.

These methods, in fact, are incapable of curing the evil, because it is not the superabundance of ascending sap that disposes trees to run to wood and causes the blossoms to fall off; but the too great elasticity of the bark of the tree while still young, that suffers the whole of

of the descending sap to proceed to the roots, to augment their growth and to form new teguments between the wood and the bark. When these vigorous trees have attained such an age, that their bark has acquired strength and solidity, then the sap, interrupted in its circulation while descending, remains in part among the branches, strengthens the blossoms, nourishes the fruit, increases its size, and advances its maturity. It is evident that if the sap can be retained by artificial means we shall obtain the same end, which is effected by nature only after a considerable number of years; the tree will be rendered fruitful. The most certain method of producing this effect is the annular excoriation.

Buffon was led to the discovery of this process so important to agriculturists by the following circumstance. Having read in Vitruvius, that "before trees are felled a hole ought to be bored at the bottom of the trunk to the centre, and that they should then be suffered to dry standing, after which they are much better for immediate use;" and finding in Plot's Natural History that "in the neighbourhood of Stafford it is usual to strip off the bark of trees near the root at the time when they are full of sap; that they are then left standing till the following winter, by which means the outer part of the wood becomes harder, and may be employed for the same purposes as the heart:" — the Pliny of France resolved to make some new experiments on this subject.

He, therefore, in May 1733, directed the trunks of a number of oaks of different ages and sizes to be stripped of the bark: and at the same time from a like number of trees of a similar description, he cut away the bark round the whole circumference of each for the space of three inches, at the distance of a yard from the ground. The results of this experiment were as follow: From the upper

per edge of the wounds, both of the trees that had been stripped, and those with the annular excoriations, proceeded a thick cushion-like substance or skin, which extended about an inch downwards during the first summer. In the young trees this substance was of greater extent than in the old ones.

Those trees whose trunks had been entirely stripped, lived a longer or shorter time in proportion to their strength; the youngest perished the first year, and the most vigorous lived till the end of the fourth. The above-mentioned substance or skin did not extend any farther after the first year, but only swelled a little. I shall now proceed to the effects of this operation.

The solidity, strength, weight, and hardness both of the inner and outer wood of the trees that had been stripped were considerably increased. The tegument between the wood and the bark, and which in the ordinary course of nature is not converted into perfect wood till the end of fifteen years, had become harder than the heart of the best common timber. The outside of this tegument was stronger than the inside, while the contrary is generally the case, as its density diminishes the nearer it approaches to the bark.

I must refer to Buffon's Memoir * for a more detailed account of these experiments, from which results this important fact, that by thus stripping off the bark, double the quantity of wood may be obtained from a tree to what it furnishes by the usual practice; and that by this same method a tree forty years old may be used for purposes, for which otherwise we are obliged to employ one of sixty years. The wood of those trees of which only three inches of the bark had been cut away, was

* Memoirs of the Academy of Sciences for the year 1738.

harder

harder than common wood, but was inferior in strength one-fourth to those which had been entirely stripped.

I think I recollect having read in some work, that this method of peeling standing timber trees prevents the wood from being liable to be worm-eaten.

Buffon made the same experiments on fruit-trees. Besides the appearances described above, he observed that those trees were covered, the second and succeeding years, with a greater number of flowers, and at an earlier period than they would have produced without this annular excoriation. That great naturalist judging that the interruption of the course of the descending sap, occasioned by his operations, could alone be the cause of the extraordinary increase in the number of blossoms upon these trees, thence drew this conclusion, that all the operations capable of producing this interruption would be the proper means of hastening the season of fecundity of fruit-bearing plants, and of producing fruit from sterile trees, which shoot out an exuberance of wood and nothing else.

It is unnecessary to state, that the following observations relate neither to the stone-fruit trees, nor those which like them produce the more fruit, the more they run to wood; they apply only to apple-trees, and those which like them do not become fruitful till age has, to a certain degree, checked the luxuriance of their vegetation.

Manner of making the Annular Excoriation to render fruitful such Trees as are apt to run to Wood.

1. To make this annular excoriation with a view to render fruitful a tree of this description, the early days of spring should be chosen; the sap having then begun to rise, the bark no longer adheres to the wood.

2. Cut

2. Cut away a slip of the bark of the trunk just below the branches, if you wish the whole tree to bear, or at the bottom of any particular branch that you may chuse to render productive. Attention must be paid not to leave upon the wood thus stripped of the bark, any portion of the interior teguments of the bark called *liber*. I have found by experience that on trees, one decimetre in diameter, the annular excoriation should not be made above 7 or 8 millemetres in breadth, that it may heal before autumn. On branches four or five centimetres in diameter take away no more than three or four millemetres, and so in proportion either for apples or stone-fruits, when you want to hasten the time of their ripening. An apple-tree requires a narrower excoriation than a pear-tree, and the quince a still narrower than the former.

3. Branches less than two decimetres, in diameter, on which an excoriation of this kind has been made, are very liable to be broken in that part by the least bending or agitation. It is therefore useful to strengthen them by means of a strong stick tied at a little distance above and below the wound.

4. If the wound be made on the trunk of a tree, care must be taken to break off all the shoots that appear below it, otherwise the ascending sap taking its course into them, the head of the tree will languish for want of nourishment.

5. A few days after the removal of the bark, from the upper extremity of the annular wound, between the wood and the bark issues a production at first succulent, glutinous, soft, and herbaceous, which hardens by degrees, assumes the colour of the bark, and forms all round the tree a ring of a semicylindrical figure, that is closely attached to the wood.

This ring or skin continues to extend over the surface of the denuded wood, without, however, adhering to it. When the wound is not too wide it reaches the lower edge, and the wound is cicatrised in the first year: the tree is then safe. The increase of this ring after the first two or three months is almost imperceptible. If the wound has been made too wide, and the skin has not united with the lower bark, the circulation of the descending sap is prevented, and before the fourth year the wound will kill all the wood that is above it. No apprehension of this kind needs to be entertained if, in cutting away the bark, the proportions I have already mentioned be observed.

6. If in the second year the tree or branch upon which the operation has been performed, is not covered with a sufficient quantity of fruit-buds, make in the spring a new excoriation either on the same place as that of the preceding year or in any other. In case of necessity it may be repeated at the beginning of each succeeding spring, till the tree or branch is found sufficiently fruitful.

There will seldom be occasion to repeat the operation. The first wound is usually efficacious, and the tree plentifully covered with fruit the second year.

7. If the operator be fearful of making the wound too large, and that it will not be closed before autumn, he may make it very narrow, and if before the month of Messidor the new ring or skin have reached the edge of the lower bark, a little more of the latter may be taken away, at the same time recollecting that the increase of the skin is extremely small after the two first months.

This process employed in the manner, and with the precautions which I have stated, is infallible, speedy in its effects, and not attended with any injury or inconvenience.

8. In

8. In pruning fruit-trees it is of no use to cut out the luxuriant wood, or to endeavour, by means of pruning, to divert the sap. They should be suffered to grow freely for a year, but the following spring the bark may be cut away at the base of each of these branches; and thus by interrupting the course of the descending sap, you will obtain from them excellent shoots, and frequently fine early fruit.

9. When a shoot is grafted, the sap which it contains descends, and forms at the bottom a skin which issues from between the wood and the bark. On this skin rise small protuberances, each containing a ligneous fibre proceeding from the stem of the shoot; this fibre increases in length and becomes a root. Substances of a drying nature frequently kill the shoot during its temporary exhaustion by the descent of the sap, for the formation of the skin and roots, and before those roots have derived nourishment from new juices. If only such shoots be grafted which have the skin already formed at their base, the roots will strike out sooner, the shoots will not be so long deprived of sap, and they will be sure to thrive, being only a short time exposed to the action of destructive matters.

Conformably with this principle, in the spring of the year 9, (1801,) I grafted several branches which I had left on an apple tree trained as an espalier. In the spring of the year 10, (1802,) the grafts had grown very much, and the branches had increased, so as to be two centimetres in diameter. From the bottom of each I took away the bark for the space of two centimetres, not wishing the wound to cicatrise. A skin about three millemetres in breadth was formed on the upper edge, and the same year the branches bore a great quantity of apples,

which would have ripened had they not been blown off by a violent wind.

These branches are two metres in length, and have shoots branching out from their tops; I cut them this autumn, (1803,) below the ring of skin, taking care not to injure it, and planted them without taking off any of the small branches. They are very green, the buds are already large, and I hope they will form standard trees.

This process of the annular excoriation may be employed with success, to hasten the maturity of grapes a fortnight or three weeks, and to ripen grapes trained on a trellis, which frequently remain unripened to the end of the season.

The fruits of trees or branches on which this operation has been performed, are always earlier by fifteen or twenty days, and larger, than those produced by trees that have not been subjected to the operation. May not this be the method employed by the hoary philosopher described by Virgil? He had discovered the secret of obtaining the earliest roses in spring, and the earliest fruits in autumn.

Primus vere rosam atque autumno carpere poma. GEORG.

In confirmation of the above statements, I shall relate some of the experiments which I have made. As the subjects of them I selected healthy trees 14 or 15 years old, planted in open ground in a light and rather damp soil, some of which had several times flowered, but never borne any fruit, most of them never having produced buds for fruit.

It was in the spring of the year 9, (1801,) that I made all the annular excoriations, of which I am about to state the results.

Experiment

Experiment I. On the 12th Messidor, year 10, (1802,) I gathered ten very juicy and perfectly-ripe apricots from a branch of a tree submitted to the operation. At that time the apricots on the rest of the espalier were still small and green, and the earliest were not ripe before the 30th Messidor. The branch, from which I had pared the bark, was four centimetres in diameter; it bore twice as many apricots as other branches of the same espalier of equal magnitude; its fruit was one third larger and earlier than that of the rest of the tree by 18 days.

Experiment II. In the spring of the year 9, (1801,) I pared away the bark from the bottom of one out of two branches, forming the head of a standard apple-tree. The other branch of equal extent and thickness with the first, and forming the other half of the tree, was not submitted to the experiment. That year, like all the preceding, without exception, there was no fruit on either of the branches.

In the spring of the year 10, (1802,) the young shoots were nearly of equal size on both the parts of the tree, and I cut out none of them.

On the 20th Messidor, upon that part of the tree subjected to the experiment there were thirty apples, principally on the young branches which bent beneath the weight. One of these apples taken at random weighed nine ounces; the only apple that was at the same time on the other side of the tree weighed only two ounces.

The young branches on that side of the tree not submitted to the operation, had grown one-third larger and thicker than those on the side where the excoriation had been made.

Experiment III. On a very healthy apple-tree that had never borne fruit, and was divided into four branches equal in thickness and extent, I made in the year 9, (1801,)

two

two annular excoriations on two of the branches. That year there was no fruit because there were upon the tree no fruit-buds formed the preceding year. The young wood grew nearly equally on all the branches of the tree.

In the spring of the year 10, (1802,) I pruned one of the branches on which I had made the annular excoriation and one of the others, leaving the new wood on the two remaining branches.

I observed: 1. That the branch submitted to the operation, and pruned had produced very few shoots, and that these were both short and small. The branch not submitted to the operation and pruned, had produced a great number of vigorous shoots.

2. The young shoots, left on the other branch submitted to the operation, had increased very little in their dimensions; while those of the branch on which I had not operated had grown very much.

3. The two branches, not submitted to the operation, produced no fruit; of the two other branches, that which had been pruned bore fewer apples than that not pruned, the young shoots of which were covered with fruit.

Experiment IV. In the year 9, (1801,) I made an annular excoriation on a branch of a pear-tree trained as an espalier; but did not meddle with the other branch forming the other half of the tree. The same year the increase of fruit was considerable. The 10th Thermidor, year 10, (1802,) from the part submitted to the operation I gathered pears perfectly ripe, weighing four ounces each, while those from the other half of the tree weighed no more than one ounce and a half. On the former, the number of pears that ripened was 84; the latter produced only 9 small ones, which dropped off before they arrived at perfect maturity.

It

It is necessary to remark, that there were as many blossoms on one side of the tree as on the other; but that those on the side where the excoriation was made were all fruitful, while almost all those on the other side fell off.

I think it superfluous to weary the reader with a greater number of facts, as the above will suffice to demonstrate the efficacy of the process here recommended.

Process for extracting Soda from Minerals.

From KLAPROTHS'S ANALYSIS of MINERAL SUBSTANCES.

THE analysis of sonorous porphyry *(klingstein)* forms the subject of a memoir read by M. Klaproth to the Academy of Sciences of Berlin the 25th June 1801. The author begins by observing how little attention has been paid to the analysis of the most common mineral substances by those chemists who have devoted their labours to that kind of research, though the knowledge of their composition is highly important to the science of Natural History. He then enters into some interesting details relative to the history of the mineral, of which he is about to present the analysis; according to which it appears that Ferber and De Born considered it a variety, sometimes of argillaceous, sometimes of micaceous schistus; that M. De Charpentier was the first mineralogist who imagined that it was a distinct substance, to which he gave the name of *corneous schistus* (horn-schiefer); that M. Werner, having afterwards observed it with attention, discovered that its structure resembled porphyry, containing in its composition crystals of feldspath and hornblend, and that he gave it the name of *porphyric schistus*, because it might be separated into laminæ. M. Klaproth thinks

thinks this denomination should be changed; he therefore gives it a name taken from that of the mass, which constitutes this porphyric rock; he calls it *klingstein porphir*, that is, porphyry with a basis of sonorous stone.

The specimen of the klingstein which M. Klaproth employed for this analysis, was taken from the mountain of Millischau, in Bohemia. When ignited for half an hour, it lost three *per cent* of its weight; its colour, originally of a greenish-grey, became a whitish-grey. In a porcelain-furnace it was fused into a thick vitreous matter.

The author then enters into the details of the analysis; the results of which are:

Silex	57,25
Alumine	23,50
Lime	2,75
Oxyd of iron	3,25
Oxyd of manganese	0,25
Soda	8,10
Water	3,00
Loss	1,90
	100

The specific gravity was equal to 2,575.

This analysis led M. Klaproth to his ingenious manner of extracting the soda existing as a component part in certain mineral substances. The following is the process by which he effects that purpose.

"One hundred grains of very pure klingstein were pounded with 400 grains of nitrate of barytes; the mixture being put into a porcelain crucible, was at first exposed to a moderate fire, which was gradually raised to a red heat; when the bubbling ceased I increased the degree of heat; but upon uncovering the crucible I observed

served some thick whitish vapours rising from amidst the viscous matter, and apprehensive that the soda was escaping in a volatile form, I slackened the fire.

"The matter when cold was of a light blue colour, porous like a spunge, and very friable; when dissolved in muriatic acid diluted with a large quantity of water, I obtained a solution of a yellow colour, and perfectly limpid; this I put into a porcelain retort, upon a sand-bath, and gradually added so much sulphuric acid that there was sufficient not only to precipitate the barytes, in the form of sulphate, but likewise to predominate perceptibly, after having entirely disengaged the muriatic acid.

"The evaporation was continued to a moderate degree of dryness; the residue was diluted in water; the sulphate of barytes and silex which remained at the bottom were separated by the filtre; and the solution, which was limpid, was saturated and precipitated with ammoniac. The sediment that was formed was again separated by the filtre, and the solution evaporated to dryness. The saline residue, thus obtained, was put into a porcelain crucible, and exposed to a moderate degree of heat till all the sulphate was evaporated. The fixed part, that which remained in the crucible, was diluted with water, and afterwards crystallized; the crystals were pure sulphate of soda. This salt was again dissolved, and afterwards decomposed by acetite of barytes; a sulphate of barytes was precipitated, separated by the filtre, and the solution evaporated to dryness. The acetite of soda was exposed to a red heat in a crucible of platina; the coaly residue dissolved in water and filtered, furnished a ley, clear and colourless, from which were extracted, by evaporation, 14 grains of carbonate of soda, yielding $8\frac{1}{10}$ grains of pure soda. Dissolved in nitric acid, and left to crys-

crystallize, it formed crystals of nitrate of soda of a rhomboidal form.

"The quantity of soda contained in the klingstein may be regarded as rather greater than what I have here stated; because, besides the loss inevitable in the operations through which any substance that is analysed must necessarily pass, the thick filamentous vapours that escaped when I uncovered the crucible in which I ignited the mineral with the barytes, appeared to me to proceed from a volatilization of the soda."

M. Klaproth concludes his memoir with remarking the importance of the discovery of soda in a mineral substance, of which whole chains of mountains are composed: this alkaline substance is equal to one-twelfth in the composition of the klingstein. He observes that the mountain of Millischau alone, which is nearly a perfect cone, above 800 metres in height, would afford a supply of soda equal to the consumption of all Europe during a long series of years, if a convenient method of extracting it could be discovered.

Notice on several Processes, but little known, employed for gilding and silvering Metals.

From the Annales des Arts et Manufactures.

THE lustre of gold is pleasing to every eye; but this precious substance is so rare, that the arts have been obliged to resort to various methods of multiplying it in appearance, by slightly covering the most common metals with this costly material. Such is the origin of gilding.

For the purpose of gilding, the artizan either covers the metal directly with a leaf of gold, or he forms an

amalgama

amalgama of gold and quicksilver, with which he rubs the metal, and afterwards volatilizes the quicksilver by means of heat.

The success of this operation depends in a great measure on the attention that is paid to render perfectly clean the surface of the metal which is to be united to the gold, because then the junction is more perfect. Silver, copper, brass, and pinchbeck, may be gilded with ease by the two above-mentioned methods; but steel and iron oppose many obstacles, and cannot be gilded in a permanent manner by any of the processes hitherto discovered. The reason is, that the surface of steel and iron cannot be kept perfectly clean during the operation.

Application of Leaf-Gold to Iron or Steel.

In this process it is necessary to begin with heating the metal upon which it is proposed to apply the gold. This circumstance requires particular attention on the part of the artist, for if he does not heat it enough he runs the risk of not obtaining a sufficient power of adhesion; and if he heats it too much he is liable to subject the metal to the commencement of oxydation, besides incurring the danger of destroying the temper of sharp instruments, as swords, daggers, &c. that are to be heated.

Of gilding with the Amalgama and Nitrate of Mercury.

The difficulty of the operation, and the danger of its failure, are augmented, if it is intended to gild iron or steel by means of the almalgama; for as the metal has no affinity with the mercury, an intermediate matter is required to dispose its surface to receive it. For this purpose the parts that are to be gilded are wetted with a solution of mercury in nitrous acid, which mordant is denominated by artists *mercurial water*. The acid, which has

a greater affinity for the iron than for the mercury, attacks the former, and deposits a thin layer of mercury instead of that of iron, which it takes away. This layer effects the union of the amalgama which is then applied with the iron; which combination would not have taken place without it. But by this process the surface of the iron is injured by the action of the nitric acid, and the union is so slight that a brilliant and durable gilding can never be produced by this method.

Of gilding with the Amalgama and the Sulphate of Copper.

Sometimes with a camel-hair pencil a solution of sulphate of copper is applied to that part of the steel which is proposed to be gilded. By a chemical affinity, exactly similar to that just described, a thin layer of copper is precipitated upon the iron. The copper having an affinity for the mercury, is capable of serving as an intermediate substance, and effecting a kind of union between the amalgama and the iron.

But in both of these processes the surface of the steel is always injured by the action of the acid, and in both a degree of heat must likewise be employed sufficient to volatilize the mercury. In consequence of these disadvantages most artists adopt the first process, which consists in applying the gold-leaf to the metal when hot, and in fixing it by the action of the burnisher. This process is troublesome, but the surface of the iron is less liable to be injured by it.

Improved Process for gilding Iron or Steel.

This process, which is not so generally known among artists as it deserves to be, may be useful to those who are required to gild iron or steel. Into a solution of gold in nitro-muriatic acid pour about twice the quantity of ether;

this

this mixture should be made with care, and in a large vessel. Shake the two liquids together, and as soon as the mixture has settled, the ether will be seen separating from the nitro-muriatic acid, and floating on the surface. The acid becomes colourless, and the ether acquires a colour, because it takes away the gold from the acid. The two liquids are poured into a glass funnel, the pipe of which must be very small, and must be stopped till the two fluids have settled, when they will be completely separated from each other. Being then opened, the acid which, on account of its weight, is lowermost, runs out the first; when it is entirely drawn off, stop the funnel, which then contains only the solution of gold in ether; this is put into a phial, well corked, and kept for use.

To gild iron or steel, first polish the surface with the finest emery, or rather with colcothar moistened with brandy. Then, with a small brush or pencil, apply the auriferous ether; the liquid soon evaporates, and the gold remains. Heat, and afterwards rub it with the burnisher. By means of this solution of gold in ether the artist may, with a pen or pencil, trace all kinds of figures upon iron, and we conceive that this is the method employed for plating the wares of Sohlingen. As every artist may not have at hand the receipts for the best method of preparing nitro-muriatic acid and ether, we shall here introduce both.

Method of preparing the Solution of Gold in Nitro-muriatic Acid.

Into a sufficient quantity of nitrous acid put as much sal-ammoniac as it is capable of dissolving cold, and even in a cool place. Into this acid put gold reduced to filings or thin leaves, and place it in a situation where it will become warm till the metal is completely dissolved. The

solution

solution assumes a yellow colour, being that of the gold, and stains the skins of animals purple.

Method of preparing Sulphuric Ether.

Into a large retort put one pound and a half of highly-rectified spirit of wine, to which pour slowly two pounds of the most concentrated sulphuric acid, slightly agitating the mixture as you add the acid. The mixture will become warm, and the vapours that will be abundantly disengaged will have a pungent smell. When you have poured in all the sulphuric acid, add half a pound of spirit of wine, which will rince the neck of the retort on its passage, mix the whole well, and let it stand for some time, previously closing the mouth of the retort.

Place it afterwards on a sand-bath; adapt to it a large recipient, and kindle the fire: it should be slow and moderate, and the heat ought not to be communicated to the recipient. Continue the operation till a sulphuric smell is emitted from the globe of the recipient. Unlute and collect the produce, which is a mixture of ether, acidulated water, spirit of wine, sulphuric acid, and a carbonic matter.

To rectify this, put it again into a retort; and after adding a small quantity of alkali to absorb the acid, place the retort on the sand-bath, which heat very moderately; the first half of the liquid that passes over is extremely pure ether.

The residue of the first distillation may be employed to prepare a farther quantity of ether. It will be sufficient to pour upon it some good spirit of wine, but less in quantity by one-third than the first time; distil, rectify, &c.

Another

Another Process for the Purposes of gilding.

Those who may find a difficulty in preparing ether may substitute for that liquid an essential oil, as spirit of lavender, oil of turpentine, &c.: these liquids possess the property of separating gold from a nitro-muriatic solution.

Method of preparing Alkohol.

As it is frequently difficult to procure highly-rectified alkohol, this may be effected by employing the following process with weak spirit of wine.

Take potash, perfectly dry, and sprinkle it over the spirit of wine: the alkali will unite exclusively with the water, and the supernatant liquor will be the purest spirit of wine. Decant it, and repeat the same operation, till the potash ceases to contract moisture in the liquid. The alkohol becomes extremely pure, but it is coloured by the action of the potash. To take away this colour, distil it in a retort, with a gentle fire, and the first four-fifths will be perfectly-rectified spirit of wine.

Of gilding Silver cold.

Independently of the preceding methods, silver may be gilded cold, and with great ease, by means of the following process.

Dissolve some gold in nitro-muriatic acid, and dip linen rags in the solution. Burn the rags, carefully preserving the ashes, which will be very black, and heavier than common ashes. Rub them on the surface of the silver you intend to gild, for which purpose the finger, or a piece of leather or cork, may be employed. This action attaches the particles of gold to the surface of the silver: wash the latter, when you will perceive some slight traces of

of gilding; which will appear much more distinctly when rubbed with the burnisher.

Of gilding Brass.

The surface of delicate instruments made of brass may be preserved a considerable time uninjured, by gilding them in the following manner.

Procure a solution of saturated gold, and after having evaporated it to the consistence of oil, leave it to crystallize. Dissolve the crystals in pure water, and after plunging into this solution the articles that are to be gilded, wash them in pure water, and submit them to the action of the burnisher. Repeat the process till they are completely gilded. The solution of the crystals of nitro-muriate of gold is preferable to a simple solution of the metal, because the latter always contains a portion of acid at liberty, which attacks more or less powerfully the surface of the brass, and destroys its polish.

Method of varnishing Brass.

A varnish, very much resembling gilding, may be applied to brass, by covering it with a solution of gum-lac in spirit of wine. It preserves its brilliancy as long as the varnish lasts. The articles prepared in this way must not be rubbed with too hard a brush, or with chalk; they must only be wetted with linen-rags. This varnish is prepared in the following manner.

Dissolve two ounces of very pure gum-lac in forty-eight ounces of alkohol, and place the solution upon a sand-bath in a moderate heat. To prevent part of the spirit of wine from evaporating as well as the vessel from bursting, if too closely stopped, cover the neck with a bladder, in which several holes must be made with a pin. In another vessel, and in the same quantity of spirit of

of wine, dissolve an ounce of gum-tragacanth, in grains. Mix the two solutions when complete; put into it three grains of sanders wood, and let the whole stand for twelve hours in a moderate heat. Filtre through paper, and keep it for use in a very clean phial. Sanders wood is preferable to any other substance for giving a gold colour to the varnish made with lac. If you intend it to be pale, and not to alter the colour of the brass, omit this colouring principle; and if you want a darker yellow add half as much more wood as the quantity specified above.

Notice on the Dutch Method of salting Herrings.

From the ANNALES DES ARTS ET MANUFACTURES.

THE Dutch are acknowledged to understand the art of salting herrings better than any other European nation; therefore some account of their method of preserving those fish may not be deemed unacceptable.

As soon as the herrings are caught, the fishermen immediately proceed to pack them; preparatory to which they open the gills, and with the fore-finger and thumb, they pull out the entrails, liver, and stomach, together with the intestines and the fat membrane, which always adheres to them, but without separating the latter. They are then plunged into a strong brine of salt and water, and afterwards hung up till they have drained sufficiently dry.

When this operation is completed, they proceed to the packing, which consists in stowing them away in barrels as closely as possible, in layers, with a stratum of salt over every layer of herrings; taking care to place the fish of

of each succeeding layer in a contrary direction. The barrels are then closed. The greatest attention is paid to select such casks as are sound and well hooped, for if the air gets admittance the fish are spoiled. The herrings are thus left in salt a fortnight if fine salt has been employed, or three weeks, or a month, if it be of the coarse kind, by which time they are sufficiently impregnated.

Upon the return of the vessel to port, the barrels are immediately landed, and conveyed to the place where the process of curing is completed.

The subsequent operation is the most important part of the Dutch method, as it prevents the tendency of the liquor, charged with lymph and blood, to putrefy. It depends upon a process, by which the oil contained in the liquor being made to commix with the water, or reduced to a saponaceous state, is preserved from the action of the air, and is consequently less liable to become rancid.

When the herrings have been sufficiently stirred to disengage the lymph and blood from them, the barrels are emptied upon large tables or benches, provided with ledges, which are inclined in such a manner that the liquor which drains from them may run into a tub, placed underneath. This liquor is put into an iron pot, and boiled; during the ebullition the scum is taken off, and it is then emptied into a wooden vessel, where it is left to cool.

They then take the roes of thirty herrings for each barrel, and pound or triturate them in a stone mortar, mixing with them a small quantity of the liquor as the trituration proceeds, till they reduce it to the state of an emulsion, or a saponaceous liquor. This they pour into the liquor that has been boiled, and removed into the wooden vessel, and the whole is mixed together. The

fish

fish are then packed in the barrel, where they are placed in the manner already described. When the cask is filled, the top is forced down upon the fish; for which purpose a press is employed, as well as to press down the herrings from time to time during the package. This pressure is useful for preserving them, and causes each barrel to contain one-third more than in the first operation. The liquor boiled and mixed as above is then poured in at the bung-hole till the cask is quite full; when the herrings cease to absorb any more liquor the bung is driven in, and the casks of herrings are ready for sale. The liquor is only used when cold.

Intelligence relating to Arts, Manufactures, &c.

(Authentic Communications for this Department of our Work will be thankfully received.)

The following Observations, on the Introduction of improved Machinery in the Woollen Manufactory, are by Mr. JOHN ANSTIE.

IN the year 1791 serious apprehensions were entertained of the shearmen, and other persons employed in the woollen manufactory, committing fresh outrages on the property of those clothiers, in the county of Wilts, who at that time had more generally begun to scribble wool by machinery.

The contest between the clothiers of the counties of Wilts, Gloucester, and Somerset, and the work-people, is now brought to a crisis, by the application of the former to the legislature for a repeal of the obsolete laws respecting the woollen manufacture, particularly those on which the latter ground their opposition to the farther progress of machinery in diminishing labour.

That the woollen business in the county of Wilts, in particular, is at present in a depressed state cannot possibly be denied; and no one, who feels himself in the least interested in its prosperity, can be insensible to the event of the present disputes between the clothiers and the work-people.

The introduction of almost all kinds of machines into the woollen manufactory in the county of York, without obstruction from the work-people, originated in very favourable circumstances, which, if necessary, could easily be pointed out; and the rapid increase of the manufacture, since the more general improvements of machinery in that county, must evince the superior benefits derived by those persons who are enabled to reap the advantages of ingenious discoveries for diminishing labour.

The little opposition made in the county of Gloucester, by the work-people, to the improvements in the manufacture, till the shearing frames were attempted to be introduced, must also be attributed principally to favourable existing causes, though the increase of the woollen trade of that county must perhaps be considered as originating principally in the superior mode of dressing superfine cloths.

Unfortunately, so far from there being any thing existing in the state of the county of Wilts, particularly favourable to the introduction of machinery, when the improved mode of spinning began to prevail, that circumstances of a local nature were peculiarly adverse to its being introduced into that county.

A large district of the county, where no manufactories were established, depended almost entirely on spinning of wool, carried there not only by the clothiers from Bradford, Trowbridge, Devizes, Melksham, &c. but even from some of the manufacturers in the counties of Gloucester

Gloucester and Somerset.—When, therefore, the far greater part of the clothiers ceased from carrying wool for spinning to that district, the spinners were thrown out of employ, and no previous measure having been taken, no adequate substitute could be found for the loss sustained by them.

Their situation at that time was truly distressing to the feelings of humanity;—and the warmest advocate for the introduction of machinery, if not absolutely destitute of all kind of commisseration for the sufferings of others, could not but be anxiously desirous of devising means for their being employed.

This, in all human probability, must have been the necessary consequence eventually, had not spinning by machinery, on the improved machines (as in fact the spinning turn, strictly speaking, must be considered as a machine), as well as scribbling and carding wool by different and more expeditious modes, been introduced into that county.

Though it would be easy to point out the beneficial consequences necessarily following the application of machinery in other branches, these observations will be confined more immediately to the woollen manufacture.

Respecting the probability of an increase in the annual product of wool, for forming an accurate opinion on the subject, it would be necessary to know the actual excess of the value of the raw material imported from Spain and other parts, within the period that was given in the accounts laid before the House of Commons.

To this must be added its additional value, by the expense incurred of manufacturing it.

If this total amount should not appear to be equal to the increased value of the exports (making proper allowance for the advance in price, as noticed before), in a

certain

certain period, it would afford a pretty decided proof, that our native wool was actually increased in quantity, except it should be supposed our own internal consumption of woollen goods had been diminished *.

Though some allowance must be made for the advance in the price of goods, as before-mentioned, yet perhaps sufficient reliance may be placed on the account delivered to the House of Commons, from the Custom House, to afford general proof, that our native wool must have rather increased in quantity.

	£.	s.	d.
In the year 1799, the exports of woollen goods amounted to -	6,876,939	8	3
In the year 1790, they were only	5,190,637	13	6
Difference - - - -	£ 1,686,301	14	9

The account of the imports of foreign wools does not go back farther than 1791, but one year can make no material difference in this general view of the subject.

In the year 1792, the total amount of the import of Spanish and other foreign wools was - - -	4,935,839 lb. wght.
In the year 1791, it was - -	2,776,074
Difference - - - -	2,159,765

As it is impossible to ascertain the proportion between the finer wools and others of the coarser quality imported, there are no means of making an accurate calculation of the actual value.

* Though the use of Norwich and other woollen stuffs has so much declined, yet there is not the least probable ground to suppose our internal consumption of woollen goods has been lessened. Most assuredly people in general consume more cloths than formerly, and the increased use of carpets, &c. must require an additional quantity of wool.

The

The writer therefore considers it to be fully sufficient to state his opinion, that the original value of the wool, and its increase in the price of manufacturing it, may be taken at about one million two hundred thousand pounds sterling.

	£.	s.	d.
The excess of the exports of woollen goods in 1799, compared with 1791, has been given as - -	1,686,301	14	9
Calculating the value of foreign wool, and the expense of manufacturing it, as stated above - -	1,200,000	0	0
The difference would be - -	£ 486,301	14	9

From the above statement it appears, the surplus of exported woollen goods in 1799, after deducting the value of foreign wool imported, and its additional amount by manufacturing, over and above what it was in 1791, amounted to not much short of five hundred thousand pounds.

If the premises are well-founded, the inference is incontrovertible, that though the import of foreign wool was so much increased from 1791 to 1799, yet the export of goods from our own native growth of wool greatly increased also.

Improvement in the Manufacture of Hemp and Flax.

By a report made to the Lyceum of Arts at Paris, on a new preparation of Hemp and Flax, invented by M. Lebrun, it is stated that he gives these materials an appearance perfectly new and advantageous, and obtains a kind of cotton and silk thread from them. He begins with the tow the moment it leaves the hands of the cultivator; he communicates to it either the soft and adhesive nature of cotton, or a brilliancy resembling that of silk. It

It may be carded and spun like cotton, and when woven appears perfectly similar to that material; it takes and preserves, in like manner, various colours, of the same degree of solidity, and is capable of assuming a lustre far superior. It is well known that it is difficult to dye thread even an indifferent colour; and that it has as little lustre as solidity. According to M. Le Brun's new method, its fibres appear to be in a new state because they possess new chemical properties.

Thus an indigenous plant, abounding in France, and always low in price, is capable by means of this discovery of being substituted for an exotic material, the cotton of Smyrna, which, though of inferior quality, is always higher in price; so that a proportionate difference must ensue between the value of manufactured cotton goods and those of materials of French production. This advantage will be accompanied with another, say the reporters, we shall be relieved from the apprehension of circumstances making cotton dear and scarce, which has frequently been occasioned in time of war, by the interruption of our communication with those countries which supply us with that article. These important considerations remove every doubt respecting the advantages which the nation will derive from the abundant production of this species of indigenous cotton. This abundance cannot be disputed, since, with the labour of a few individuals, 1000 lbs. of tow may, in 24 hours, be converted into cotton. The reporters therefore considered this preparation of the utmost importance, as the produce of it may be employed for a great variety of purposes. Of this they were convinced by the examination of 28 samples of hemp and flax in skeins, carded and manufactured by M. Lebrun. They observed a piece of cotton-velvet, a piece of shag, dyed six different co-

lours;

lours; a piece of striped muslin, and a remnant of white muslin. The whole of these were composed of vegetable matters, and the most rigorous experiments have confirmed the success of the process.

A second preparation likewise affords resources to the industry of the country. In brilliancy and the fineness of its texture it rivals silk. The reporters convinced themselves that this silky appearance cannot be destroyed by the action of leys; they boiled several samples in potash, which is certainly the severest test; it was perfectly harmless, and the brilliancy remained unchanged. From this experiment it appears, that this material will be of extensive utility in the manufacture of a variety of small articles, and, as it is capable of taking different colours, it will be productive of the most advantageous effects. When dyed it assumes the appearance of silk, and yet retains the state of a vegetable substance. This remark is made, because if a portion of any stuff, of which silk composes a part, be burned, a smell of ammoniac is disengaged. The reader might hence be led into an error, or to suppose that this phenomenon had escaped notice; the only result is, that in the manufacture of those stuffs, silk has been employed either for the warp or for the stripes. This preparation will, therefore, be of infinite service to manufacturers, from the variety of ways in which it may be employed, while its price will in many instances cause it to be preferred to silk, part of the beauty of which it, at the same time, possesses.

Advantages of deep ploughing for Potatoes.

At Michaelmas, 1802, Mr. Gardiner, of Boldre, near Lymington, took possession of about eighty acres of arable land, that had been exhausted by a tenant. Sixty

acres

acres had been under white corn five years successively, the last crop principally wheat, slight enough as may be supposed, and a full crop of every sort of trumpery. The soil is naturally a dry, deep, strongish loam. As soon therefore as rain enough had fallen to allow the plough to go the desired depth, Mr. Gardiner broke it up full ten inches deep, burying, by means of a skim-coulter, all the stubble and trumpery. In this state forty acres of it were left till the beginning of April. By the frosts the ground was crumbled quite fine, and there was not a very full appearance of weeds. It was laid in four-bout lands, of about six feet. The second week in April a double mould-board plough was run along the centre of each ridge, and had cuttings of the white globe potatoe, set about nine inches apart, by women and children following the plough. All the dung that could by any means be scraped together was taken from out a cart that went down the intervals, and was spread with a prong lightly and sparingly over the potatoes, and covered with earth by a common light plough.

About a hundred cart-loads of dung (of thirty bushels each) covered in this manner about thirty acres, and it took twelve bushels of potatoes an acre to plant it. For the remaining ten acres Mr. Gardiner had no dung, and therefore planted them the same way without it. During the summer he three times ploughed the six feet intervals, ran the scufflers twice down them, and once hand-hoed the rows of potatoes. Notwithstanding the dryness of the summer the haulm continued green and vigorous, and in the whole forty acres scarce a weed was to be seen. Having prepared a pit to store them in, and plenty of fern to cover them, Mr. Gardiner began to take them up the last week in September, and continued so doing to the first in November.. They were dug up with prongs, for

for which and picking he paid $2\frac{1}{2}$ *d. per* bag, and sold them to a dealer from Portsmouth at 6 *s. per* bag, for the whole crop, great and small, delivered at Lymington Quay, about two miles distance.

The thirty acres dunged produced on the average 97 bags *per* acre, or 291 bushels. The ten acres undunged produced, to Mr. Gardiner's surprize, 82 bags *per* acre, or 246 bushels. Mr. Gardiner, in speaking of produce, says he means *produce sold*, for he received of Mr. Miller, of Portsea, 1,119 *l.* for 3,730 bags. Mr. Gardiner adds, that in the middle of December last, the whole forty acres were as clean as a garden, drilled at $11\frac{1}{2}$ inches with wheat, and then in a very promising state.

The profit on these forty acres was 815 *l.* 4 *s.* 6 *d.* something more than 20 *l.* an acre. Mr. Gardiner attributes this great success almost intirely *to the deep winter-ploughing, a deep and good soil, formerly marled.*

Potatoes recommended for feeding Sheep.

It is stated by Mr. Bartley, of Bath, that in consequence of former experience, February, 1801, he began to feed a small flock of ewes, then in lamb, with potatoes, (raw and unwashed,) and that his shepherd was much surprised to find the ewes took to them with an astonishing degree of eagerness, after totally neglecting them for the two first days. That he continued to feed them every morning in the proportion of about $2\frac{1}{4}$ lbs. to each ewe; they would readily have taken more, but as they improved in condition very rapidly, Mr. Bartley feared it would endanger their lambing. As the lambs dropped they are supplied more liberally, to increase the milk. This practice Mr. Bartley thinks will become general wherever it is known: within the reach of his own observation some

 thou-

thousands of sheep are thus feeding. The advantage is real and substantial, at least under the existing circumstance of a prodigious surplus of potatoes, but in what proportion remains to be ascertained.

It would probably result from well-conducted enquiries of this nature, that the potatoe might generally be well substituted for the turnip. The crop is less precarious, suitable to a greater variety of soil, and to be secured against the variety of frosts with more certainty. Besides in those parts of the kingdom where the practice of hoeing is neglected, turnip crops are but of small comparative value.

Machine for measuring the Rapidity of Bodies discharged by Artillery.

At the meetings of the National Institute on the 13th and 20th of Frimaire (4th and 11th Dec.), M. Prony read a long and elaborate report on a machine, invented by Colonel Grobert, for measuring the rapidity of bodies discharged from artillery. This machine possesses the important advantage of firing with every calibre, and at every angle from zero to 45 degrees, and permits the use of every kind of frame. It is principally composed of two vertical, perforated disks, which turn round with great rapidity. They are mounted upon one common axis, and a skreen is fixed before each. The ball alternately passes through the skreens and the disks; but the hole in the second differs more or less from the direction of that of the first, according to the time which the projected body requires to traverse the space between them.

The Institute adopted the conclusions of Messrs. Prony, Monge, and Bossut, who were commissioned to examine this machine.

Account of Food consumed, and Weight gained, by Mr. WHITTLE's *Prize-Hog exhibited at Smithfield in December last.*

Date.	Age.	Weight.	Weight gained.	Food eaten.		Food which gives 100 lbs. live flesh in 3 months.
1803. Feb. 28.	6 months	161 lbs.				
May 28.	9	348	187 lbs.	15¾	Bushels of Peas and Barley.	8½
Aug. 28.	12	496	148	14		9½
Nov. 28.	15	591	95	13		13¾
Dec. 13.		595	4	1½		37½

The result of feeding this hog is remarkable, and proves the great importance of ascertaining the progression of weight gained from food given: the longer the hog is feeding the less he pays; but the loss of keeping too long does not fully appear in the last article, as it is supposed he would have proceeded for ninety days as he did for fifteen, but he would from the decline in these fifteen days probably have gained less and less.

Contrivance

Contrivance for warming Carriages.

M. Virginio, of Turin, has recently invented a machine for warming carriages. It is composed of three circular iron boxes; the first very thin in substance, ,38532 metres long, and ,12844 metres wide. This box is furnished with several feet, ,02140 metres in length; it is soldered together, and has a covering of iron which fits into, instead of upon it. The second box is ,47005 metres long, and ,42813 wide, and likewise has a lid which must fit exactly.

This lid has a rim outwards of about ,04231 metres, this space is filled with pulverized charcoal, and is closed by another lid.—The first box is introduced into the second, and in the space between them are put small pieces of iron to keep the first steady. The third is then filled with pulverized charcoal to the height of ,04280 metres; and upon this is placed the second box, the vacancy between the second and third being filled in the same manner with pulverized charcoal.

This vacant space must be closed at the top with a plate soldered over it, to prevent the charcoal from changing its position or getting out.

To these boxes three tubes must be previously adapted, one near the bottom to afford a passage to the external air into the first box; the second on the opposite side near the top, to conduct the air from the first box into the other two and out again. The three boxes are fixed by means of iron hold-fasts, or in any other way, to the bottom of the body of the carriage in front. These two tubes are enveloped in a larger tube, which is likewise filled with pulverized charcoal. This being introduced into the body of the carriage, the second tube projects behind it. Ignited charcoal is then put into the bottom of

of the first box, and the lids of all the boxes are shut down. As the carriage advances, the air enters in a violent current, by means of the first tube, into the first box; and keeps up the fire while the smoke is carried out by the second tube behind the carriage; the fire in the first box heats the air contained in the second, and that air is conducted by the third into the body of the carriage. The heat will be augmented by opening or shutting the first or the third tube, more or less, or by putting a greater or less quantity of charcoal into the first box, which may be done while the carriage is in motion.

For this purpose the charcoal of the hardest wood or stone-coal should be employed. The charcoal in the the third box prevents the heat from escaping in any other direction than by the third tube into the body of the carriage, and at the same time prevents the third box from becoming heated and injuring the carriage. The first box may even be made in such a manner as to hold a small pot for warming any kind of liquid.

New Earth called Agustine.

M. Vauquelin has examined the substance announced as a new earth by the name of *agustine*, which forms one of the component parts of the beryl of Saxony. From some experiments made on a specimen of this mineral, sent him by M. Karsten, he has ascertained that the agustine is no other than phosphate of lime.

Machine for shearing Cloth.

Messrs. Wathier and Leblanc Paroissien, of Rheims, lately invented a machine for shearing cloth. This machine has been since altered and improved by M. Leblanc, to whom the government has granted a patent,

dated

dated 4 Brumaire, year 12, (October 26, 1803.) This machine is stated to be very simple, and the more advantageous as one man sets in motion eight powers, and these may be augmented by adapting to it any moving power whatever.

List of Patents for Inventions, &c.

(Continued from Page 240.)

JOHN WOOD, of Manchester, in the county palatine of Lancaster, Machine-maker; for his new-invented improvements or additions to machines for spinning cotton, silk, and wool. Dated January 10, 1804.

JOHN SLATER, of Huddersfield, in the county of York, Surgeon; for his new-invented improved method of manufacturing and fabricating of cables, shrouds, stays, and other articles for the rigging of ships, of materials never before used for that purpose. Dated January 19, 1804.

GEORGE ALDERSON, of Carnaby-street, in the parish of St. James, Westminster, in the county of Middlesex, Lead-pipe-manufacturer; for his new-invented manufacture of metal pipes, the same being lead, lined with tin, in a manner and by a process entirely new, to be used in all cases to which lead pipes are applicable. Dated January 26, 1804.

TO OUR READERS.

In the memoir on hardening copper, in our last number, p. 234, it is said that an alloy of copper with 30 *per cent.* of tin "forms an excellent composition for making looking-glasses, spectacles, or telescopes." This absurdity is a faithful translation from the French; and a note was prepared to point it out, but unfortunately omitted by the compositor. It may be reconciled by reading, "*an excellent composition for making mirrors and specula for telescopes.*"